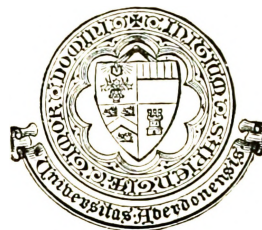


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Studies
on
Alcyonarians and Hydroids

(Third Series)

By

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Aberdeen

Printed for the University

1909

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The Hydroids of the Scottish National Antarctic Expedition. By James Ritchie,
M.A., B.Sc., Fullerton Scholar, University of Aberdeen. *Communicated by*
W. S. BRUCE, F.R.S.E. (With Three Plates.)

(MS. received May 1, 1906. Read June 21, 1906. Issued separately March 16, 1907.)

The collection of Hydroids hereafter described was made in the years 1902-4 by the Scottish National Antarctic Expedition ship *Scotia*, during her cruises in Antarctic and sub-Antarctic seas.

For the opportunity of examining the specimens I am indebted to Mr W. S. BRUCE, the energetic leader of the expedition: and I also wish to thank Professor J. ARTHUR THOMSON for much assistance and advice in the course of my work.

The collection, as here described, contains 41 specimens, of which 33 are referable to 27 known species distributed among 15 genera, some of them being new varieties; while the remainder have required the establishment of 7 new species and 1 new genus. One specimen remains specifically undetermined. Thus there are in all 18 different genera, represented by 35 different species.

Before dealing with the detailed systematic aspect of these forms, a few general notes may be inserted:—

(1) The habitat of the forms shows considerable diversity. Sixteen of the specimens were associated with Aleyonarians, being found along with, or growing upon, those forwarded to Professor THOMSON for identification; eight occurred upon larger Hydroids; while two were creeping upon seaweed fronds. Sponges formed the foundation upon which several of the remaining colonies were erected.

(2) With the specimens were associated many types of life. Frequent diatoms and foraminifera lay within the hydrothecæ or upon the stems; various sponges rested upon or surrounded some of the branches; and there were also numerous climbing or encrusting polyzoa, a few cirripede galls, and occasional pycnogonids.

(3) Of new forms described the most interesting is one of those rare types, apart from the Plumularians, in which distinct nematophore structures have been found (ALLMAN, 1883, p. 6; QUELCH, 1885, p. 4), and for it we have formed a new genus, which we have named *Bruceella* in honour of Mr BRUCE. The beautiful, highly specialised coppinia-gonosome of this type indicates close affinities with the family Lafoëidæ in which it has been placed.

(4) Another new form, belonging to the genus *Staurotheca*, is also worthy of mention as showing a development of the decussate arrangement of hydrothecæ, which necessitates a slight modification in the generic characters as originally described by ALLMAN (1888, p. 75).

(5) The occurrence among the specimens of the coppinia-gonosome of *Grammaria*, which has only within the last few months been described by HARTLAUB (1905, p. 597), is of interest, since the peculiar structure of this gonosome aggregate necessitates the transference of the genus from the neighbourhood of the Sertulariidae, where it had been placed by ALLMAN in 1888, to close proximity with the far-removed Lafoeidae.

(6) Throughout the genus *Halecium*, here represented by five species, the occurrence of minute, translucent points round the rim of the hydrotheca has been noted (Pl. II. fig. 5). These points, whose use ALLMAN did not happen to observe, are small, dome-shaped thickenings on the inside of the perisarc, placed in a ring just above the base of the hydrotheca, and to these are attached short strands from a disc-like portion at the base of the polyp, which is thus moored to the walls of its insignificant hydrotheca. Such refringent puncta are not confined to the Haleciidae, for similar structures in the same position—just above the floor of the hydrotheca—were observed in the hydrothecæ of *Obelia geniculata*.

(7) The *Scotia* collection contributes also to our knowledge of the geographical distribution of Hydroids. Thus to the already wide distribution, Arctic to Antarctic, of such forms as *Lafoëa gracillima* (Spitsbergen, Norwegian coasts, British coasts, Magellan Straits, etc.) or *Obelia geniculata* (Norwegian coasts, British coasts, French coasts, Kerguelen, etc.), still another locality is added, while several new records have been made of the occurrence of less common forms.

(8) As a remarkable case of associated distribution we may refer to *Silicularia hemisphærica*, a simple Campanularian form, which has been recorded from three different localities, namely, Falkland Islands (ALLMAN, 1888), Navarin Island, Tierra del Fuego (HARTLAUB, 1905), and Gough Island (*Scotia*), and in each case it was found in close association with *Obelia geniculata*.

In classifying the specimens according to their geographical occurrence, the regions mapped out by ORTMANN (1896) and made use of by Professor HARTLAUB (1904) have been adopted. Taking these as our standard, we find that ten of our specimens fall into the Antarctic Pelagic Region, all belonging to the Southern Subregion, while twenty-nine, including all the new forms, have been found in the Antarctic Littoral Region. The remaining two were obtained at St Helena.

Before dealing with the systematic aspect of the collection, I should like to express my special indebtedness to Professor HARTLAUB's "Hydroiden der magalhaensischen Region und chilenischen Kuste" in the *Zoologische Jahrbücher* (1905), and to Professor NUTTING's excellent monographs on the American Hydroids (1900 and 1904).

Arranging the *Scotia* specimens according to the localities in which they were obtained, we get the following list:—

ANTARCTIC PELAGIC REGION.

(a) Antarctic circumpolar subregion.

Nil.

(b) Southern circumpolar subregion.

BURDWOOD BANK, 54° 25' S., 57° 32' W. 56 fms. 1st December 1903.

* *Hebella striata*, Allm.

* *Calycella springa*, Linn.

Lajoëa antarctica, Hart.

* „ *gracillima* (Alder).

* *Grammaria magellanica*, Allm.

* *Halecium beani*, Johns.

* *Syntherium robustum*, Nutt.

* *Sertularella filiformis*, var. *reticulata*, n. var.

* „ *tenella*, Alder.

* „ *tricuspidata*, Alder.

ANTARCTIC LITTORAL REGION.

FALKLAND ISLANDS.

(a) Port Stanley. 8th January 1903.

* *Campanularia angulata*, Hinks.

„ *tincta*, Hinks.

Sertularella contorta, Kirch.

Plumularia magellanica, Hart.

(b) Cape Pembroke. January 1903 to January 1904.

Sertularella contorta, Kirch.

SOUTH ORKNEY ISLANDS.

(a) MacDougall Bay. November 1903.

Obelia longissima, Pall.

(b) Scotia Bay. 25th March and 6th December 1903.

Campanularia, sp.

Obelia longissima, Pall.

* *Halecium interpolatum*, n. sp.

* *Staurotheca reticulata*, n. sp.

* *Sertularella rectitheca*, n. sp.

STATION 411, off Coat's Land, 74° 1' S., 22° 0' W. 12th March 1903.

Hebella striata, var. *plana*.

Halecium robustum, Allm.

GOUGH ISLAND. 22nd April 1904.

Silicularia hemispherica, Allm.

Obelia geniculata, Linn.

* *Brucella armata*, nov. gen. et sp.

Halecium tenellum, Hinks.

Sertularella gayi, Lamx.

CAPE COLONY.

(a) Cape Town Docks. May 1904.

Plumularia echinulata, Lamk.

„ *pinnata*, Linn.

* Indicates a new record for the Geographical Region.

(ROY. SOC. EDIN. TRANS., VOL. XLV., 521.)

CAPE COLONY—*cont.*

(b) 8 miles N. of Dassen Island. 18th May 1904.

Sertularella filiformis, var. *reticulata*, n. var.

(c) Saldanha Bay. 21st May 1904.

* *Podocoryne carnea*, Sars.* *Halecium halecinum*, Linn.*Thujaria pectinata*, Allm.*Sertularella arborea*, Kirch.* *Antennularia hartlaubii*, n. sp.* *Antennopsis scotiæ*, n. sp.* *Plumularia unilateralis*, n. sp.*Aglaophenia dichotoma* (Johns.).

ST HELENA.

Halecium robustum, Allm.,, *tenellum*, Hinks.

The systematic grouping of the species represented in the *Scotia* collection is as follows:—

I. GYMNOBLASTEÆ.

Family PODOCORYNIDÆ.

Podocoryne carnea, Sars, 1846.

II. CALYPTOBLASTEÆ.

Family HALECIIDÆ.

Halecium beanii, Johns., 1847.,, *halecinum*, Linn., 1758.,, *robustum*, Allm., 1888.*Halecium tenellum*, Hinks, 1861.,, *interpolatum*, n. sp.

Family CAMPANULARIIDÆ.

Campanularia angulata, Hinks, 1861.,, *tincta*, Hinks, 1861.

,, sp.

Obelia geniculata, Linn., 1758.,, *longissima*, Pall., 1766.*Silicularia hemispharica*, Allm., 1888.*Hebella striata*, Allm., 1888.,, *striata*, var. *plana*, n. var.*Calycella syringa*, Linn.

Family LAFOEIDÆ.

Lafoëa antarctica, Hartlaub, 1905.,, *gracillima* (Alder, 1857).*Grammaria magellanica*, Allm., 1888.*Brucella armata*, n. gen. et sp.

Family SERTULARIIDÆ.

Sertularella arborea, Kirch., 1884.,, *contorta*, Kirch., 1884.,, *filiformis*, var. *reticulata*, n. var.,, *gayi*, Lamx., 1821.,, *tenella* (Alder, 1857).*Sertularella tricuspidata* (Alder, 1856).,, *rectitheca*, n. sp.*Thujaria pectinata*, Allm., 1888.*Synthectum robustum*, Nutt., 1904.*Staurotheca reticulata*, n. sp.

Family PLUMULARIIDÆ.

<i>Aglaophenia dichotoma</i> (Johns.).	<i>Plumularia unilateralis</i> , n. sp.
<i>Plumularia echinulata</i> (Lamk., 1836).	<i>Antennularia hartlaubi</i> , n. sp.
„ <i>magellanica</i> , Hart., 1905.	<i>Antennopsis scottæ</i> , n. sp.
„ <i>pinnata</i> , Linn.	

I. GYMNOBLASTEÆ.

Family PODOCORYNIDÆ.

Podocoryne carnea, Sars, 1846.

Encrusting three Gasteropod shells from one locality there occur gymnoblastic colonies which cannot be separated from the above species. The nutritive hydranths bear from 8 to 15 tentacles, 12 being most common, while the gonophore-bearing individuals possess only 5 or 6. All the hydranths are in a contracted state, some of the larger measuring about 0·8 mm. in height. Short chitinous spines stud the investing crust at irregular intervals.

The gonophores are borne in threes or fours beneath the tentacles. The medusoid has 8 tentacles, 4 larger and 4 smaller.

Locality, etc.—On empty shells of *Nassa crepidula* from Saldanha Bay, Cape Colony. Trawl. 19th May 1904.

II. CALYPTOBLASTEÆ.

Family HALECIIDÆ.

Halecium beanii, Johnstone, 1847.

Two fragments occur, one 4, the other 7 cm. high. The characters of the species are well shown in the specimens; the polysiphonic stems and branches which distally become monosiphonic; the pinnate arrangement of the branches; the extreme delicacy of the ramuli, especially in the distal regions; the frequent tiers of hydrothecæ and the peculiar female slipper-shaped gonothecæ, with their openings placed medianly instead of at the extremity. In the present specimens, as in ALLMAN's (1888), only slipper-shaped gonothecæ occur. We note, however, that while the hydrothecæ are in some cases set on a "short basal offset from the distal end of each internode" (ALLMAN, 1888, p. 12), in the majority of cases the primary hydrotheca arises directly from and lies almost against the distal end of the internode, as figured by HARTLAUB (1905, p. 606, fig. B³, *a* and *b*). From within these primary basal hydrothecæ arise the tiers which are so common in the species.

Locality, etc.—Fathoms, 56. Date, 1st December 1903. Burdwood Bank.

Halecium halecinum, Linn., 1758.

A thick clump of stout fascicled stems and branches from the entrance to Saldanha Bay. The stems and branches are truncated at an almost uniform height, are of a dark brown colour, and bear small, hydrotheca-bearing shoots of a pale brown, and evidently of younger age. The general appearance suggests that some agency having damaged the old-established branches, the colonies have made an effort to survive by sending out many small, much-branched shoots from the older and unharmed portions of the stem.

The architecture is similar to that described by HINKS. The hydrothecæ are alternate, one towards the distal end of each internode. They are generally sessile, as described and figured by BILLARD (1904, p. 161) for young branches, and frequently they contain the base of a tier of one or two secondary cups. Rarely in place of such a tier there arises a blind regenerative stolon, the true branches arising just below the hydrothecæ. Thus it comes about that a tier of hydrothecæ frequently appears in the angle between a branch and its offshoot. Small refringent points are present round the edge of the hydrotheca as in the other species of the genus (*vide* p. 525).

Gonosome.—The gonangia, of which only male are present, occur in densely packed rows. They agree with HINKS's description and figure, being slenderly ovate and narrowing proximally into a short stalk with about two rings.

Locality, etc.—Entrance to Saldanha Bay, Cape Colony, in 25 fathoms Date, 21st May 1904.

Halecium robustum, Allman, 1888.

A fragment of a strongly fascicled, upright, much-branched colony 5 cm. in height. The branches lie roughly in one plane and are often bent at sharp angles, the older rising irregularly from the stem, while the younger are approximately alternate, and arise from the side of the proximal segment of the hydrotheca. The internodes, which are long, but whose length varies from 0·6 to 1·5 mm., are separated by slanting nodes and bear at their distal ends alternate hydrothecæ 0·2 mm. in diameter from margin to margin, adnate at one side to the internode, with an insignificant, non-everted limbus, and rarely with a tier of one or two secondary hydrothecæ. The proximal ends of the internodes are marked by slight annulations. Around the inside of the limbus are situated small, light-refracting prominences, to which, as in the other members of the genus, are attached strands keeping in place a fleshy disc at the base of the hydranth which cuts off the perisarcic cavity from the exterior. The hydranths are large and have a great number of tentacles.

Gonosome.—Not present.

Localities, etc.—(a) Station 411, off Coat's Land. Lat., 74° 1' S; long., 22° 0' W. Depth, 161 fathoms. Surface temperature, 28°·9. Date, 12th March 1904.
(b) St Helena.

The specimens differ from that figured by ALLMAN (1888) in that the branches

frequently have at their bases at least one athecate internode connecting the stem process with the hydrophore-bearing portions of the branch. The present specimens are also frequently annulated, while ALLMAN's figures indicate that the original was smooth.

Halecium tenellum, Hinks, 1861. (Pl. II. fig. 4.)

Several specimens of an extremely delicate and graceful hydroid colony, growing in bunches on the exposed axis of an Aleyonarian, are referable to this species. As HINKS's description appears to be rather vague, I give a detailed description of the specimens. The colonies are short, generally about 15 mm. in length, with unfascicled stems and irregular branches, which arise from the distal ends of the internodes, and in some cases, at least, from the base of a hydrophore. The branches lie for the most part in one plane.

The stem is thin, having near its base a diameter of a little over 0.1 mm., and, like the branches, it is divided into long slender internodes whose length varies between 0.8 and 0.9 mm. The internodes are separated by slanting nodes, between which the stem zigzags, and on each side of which are annular constrictions. The hydrothecæ, which are alternate and lie in one plane, are borne on short processes at the distal ends of the internodes. They are cylindrical, trumpet-shaped, with a large, beautifully everted limbus, and are usually prolonged by several similar segments (from two to five in number), at the bases of which, on a level with the margin of the next lower limbus, arise well-marked annulations. The diameter of a limbus from margin to margin is 0.15 mm.

The fleshy parts are in good condition, and the following points were observed:—The hydranths are large and not wholly retractile, measuring, from mouth of hydrotheca to summit of hypostome, when extended, 0.3 mm. Just above the neck there is a well-defined bulge, and above this again a disc, from the margin of which arise the tentacles, about sixteen in number, enclosing the conical hypostome. Across the interior of the hydrotheca, at the level of the base of the everted limbus, stretches a flattened fleshy disc supported by a perisarcial septum through which, by a small aperture, the coenosarc passes. The disc is moored in its place by numerous delicate strands attached to the perisarc at rather irregular intervals. At the points of attachment there arise from the limbus small, dome-shaped prominences, which, refracting the light, appear as minute, clear dots—the “refringent puncta” of the Challenger Report. The prominences are rather irregularly arranged just above the level of the septum, on which the coenosarcial disc lies, and vary in number from about sixteen to twenty on each limbus.

Gonosome.—The gonangia are ovate, broad in the proximal region, obtusely pointed in the distal. They are supported on short stalks which arise from the sides of the hydrothecæ, and always from the lowest segment in any hydrotheca-tier. They are 0.9 mm. in length by 0.45 mm. in maximum diameter.

Localities, etc.—(a) Growing on the axis of an Alcyonarian (*Thouarella*), and dredged off Gough Island, lat. $40^{\circ} 20' S$, long. $9^{\circ} 56' W.$, at a depth of 100 fathoms. Date, 22nd April 1904. (b) St Helena.

Halecium interpolatum, n. sp. (Pl. I. fig. 3; Pl. II. fig. 3.)

A number of colonies, the largest about 4 cm. high, have been found in a shore-pool. The colony is fascicled for the most part, but becomes monosiphonic distally. In the older colonies the lower portion of the stem, which is less than 1 mm. in diameter, is usually destitute of important branches, while the upper portion bears long flexuous branches, often 15 mm. in length, which leave the stem at acute angles and in different planes. This structure gives the colonies the appearance of a miniature tree. The branches arise either singly from the basal segment of a hydrotheca or directly from the hydrocaulus, in diverging pairs, one being at a slightly higher level than the other.

The stem and branches are divided into slender internodes of very different lengths, varying from over 1 mm. to 0.4 mm., and marked at both ends by an annulation. The hydrothecæ are alternate, and are borne at the distal ends of the internodes, two thecate internodes being almost invariably separated by one or more athecate internodes. Very frequently a short, annulated, hydrotheca-crowned branch arises from the basal segment of a primary hydrotheca. The hydrothecæ are usually simple, consisting of a strongly annulated peduncle about 1 mm. long, surmounted by a well-everted limbus measuring 0.2 mm. from margin to margin. Occasionally a second limbus arises on a short stalk within the first. Around the limbus occurs the row of refringent prominences found throughout the genus, and here, as in the other cases which have been examined, they serve as attachment points for strands supporting a disc at the base of the polyp.

Gonosome.—Not present.

Locality, etc.—Off rocks in shore-pool. Temperature, 30° – 32° . Scotia Bay, South Orkneys. 6th December 1903.

One of the branches ended in peculiar, stolon-like outgrowths, as is shown in fig. 3, Pl. II. The specimens, which have probably been cast by some storm into the shore-pool in which they were found, are in poor condition, being almost wholly overgrown by polyzoa. The specific name is intended to suggest the presence of the characteristic athecate intermediate internodes.

Family CAMPANULARIIDÆ.

Campanularia angulata, Hinks, 1861.

Several specimens about 1 cm. high were found creeping on an alga. The specimens agree with HINKS's description:—slightly branched stems ringed above the origin of the pedicels; strongly ringed pedicels, usually with nine rings, sometimes with only about

five, and tapering somewhat towards their distal ends; hydrothecæ campanulate, even-rimmed, usually on long pedicels. In the present specimens there are present none of the tendril-like stolons mentioned by most writers, but this is not surprising, since in most cases the distal end of the colony is wanting.

Gonosome.—Not present.

Locality, etc.—Port Stanley, Falkland Islands; 64 fathoms. 3rd February 1904.

Campanularia tineta, Hinks, 1861.

This species is represented from one locality, that from which HARTLAUB (1905) has described his specimens. The *Scotia* specimens, while apparently belonging to this species, show a considerable resemblance to *C. cylindrica*, Allm. (1876, p. 114), from which they differ in their diminutive size and in the absence of ringing at the base of the peduncle. The present specimens, which are from 1·5 to 2 mm. high, have a corrugated peduncle averaging some 0·9 mm. in height and surmounted by a ball-like segment which bears the hydrotheca. The hydrothecæ are about 0·7 mm. long by 0·3 mm. in diameter, almost cylindrical, and narrow sharply at the base. The margin is divided into twelve blunt teeth and is frequently marked by a regeneration line. The gonosome is wanting.

Locality, etc.—Creeping on weathered hydroid stems, Port Stanley, Falkland Islands. 3rd February 1904.

Campanularia, sp. (Pl. I. fig. 2.)

Lack of material forbids the assigning of a specific name to this form. Delicate simple stems about 3 mm. high and 0·05 mm. in diameter arise at irregular intervals from a creeping tubular stolon. The hydrothecæ are deep, campanulate, 0·8 mm. in length by 0·5 mm. in greatest diameter, with their cavity cut off from that of the stem by a distinct partition. Their margin is divided into twelve or fourteen teeth, a delicate line sometimes following the curves of the teeth just within the edge. The hydrothecæ, which are marked by delicate, longitudinal lines passing from the notches between the teeth to the base, are borne upon peduncles about 3 mm. long with several rings at the top. These rings seem to be fairly constant, two deep constrictions giving rise to two ball-like divisions which are followed by an indistinctly ringed portion of the peduncle, cut off from the remainder, which is smooth, by another deep constriction.

Gonosome.—Not present.

Locality, etc.—Growing on *Staurotheca reticulata*, Scotia Bay, South Orkneys. Depth, 65 fathoms. Date, 25th March 1903.

The specimen approaches *C. Hinksii* (Alder, 1857), but the typical campanulate form of the hydrothecæ, the blunt teeth, and the peculiar markings on the peduncle, distinguish it from the parallel-sided hydrothecæ, the square-topped teeth, and the

characteristic ringing of *C. Hinksii*, where the first annulation is included in the base of the hydrotheca. From *C. cylindrica*, Allm., and *C. tinctoria*, Allm., it is also distinguished by its campanulate form and its peduncle characters.

Obelia geniculata, Linnæus, 1758.

Several specimens of this well-marked species were obtained growing on the fronds of a large seaweed—*Macrocystis pyrifera*.

The hydrotheca-bearing shoots, which are generally simple and average only 12 mm. in height, arise from a creeping stolon which ramifies over the surface of the seaweed frond. The trophosome agrees with the description in HINKS's *British Hydroid Zoophytes*, but here the annulations on the peduncle are rather more variable—two or three as well as a larger number being common. Within the hydrotheca, a short distance from the base, a perisarcial ridge is well marked, supporting the flattened basal portion of the polyp. Just above this bracket there occurs an irregular ring of minute refringent spots—small prominences on the inner side of the hydrotheca wall—to which the basal disc of the polyp is attached. These prominences resemble and serve the same purpose as those found throughout the genus *Halecium* (*vide* p. 525). The polyps are well preserved, and show well the large, trumpet-shaped proboscis.

Gonosome.—Absent.

Locality, etc.—Growing on the fronds of *Macrocystis pyrifera*, Gough Island. Lat., 40° 20' S.; long., 9° 56' W. Date, 22nd April 1904.

Obelia longissima, Pallas, 1766.

A large number of weather-beaten colonies were found in the South Orkneys. The specimens are about 8 cm. high and agree closely with HINKS's description and figures. The hydrothecæ are mostly wanting; those which remain are fragile and much crushed, and probably as a consequence I was unable to detect the blunt teeth which mark the rim. The pedicels, which taper towards the top, are usually altogether ringed, but sometimes only in the proximal and distal regions, the median portion being smooth. A pedicel was frequently noted springing from the axil between branch and branchlet, as mentioned by HINKS (1868).

Subsequent specimens, residue from the seaweed collections, were in better condition.

Gonosome.—Wanting.

Localities, etc.—(a) Macdougall Bay, South Orkneys. November 1903. (b) Off rocks in shore-pool, Scotia Bay, South Orkneys. Temperature, 30° to 32°. Date, 6th December 1903.

The specimens from both localities appear to have been exposed to weathering for some time. Those from (b) especially show traces of rough usage, the branches being

broken off not far from their origin, while the greater number of the stems are covered with polyzoon growths.

Silicularia hemispherica = *Hypanthea hemispherica*, Allman, 1888.

The only representative of this genus in the *Scotia* collection occurs on the frond of *Macrocystis pyrifera*, from Gough Island. The specimens bear out HARTLAUB'S opinion that the length of the peduncle, varying as it does to a considerable extent, is not a safe specific character, for here various peduncles measure 6, 5, 4, 3, 1 mm. In so simple a genus distinctive specific characters are not easily obtained, but the following point to identity with *S. hemispherica*:—Hydrocaulus, creeping, branched, bearing at varying distances pedunculate hydrothecæ and gonangia which usually alternate with one another. The peduncles are exceedingly variable in length, rather less in diameter than the hydrocaulus, with a distal swelling, succeeded by a globular segment, and this in turn by the hydrotheca. The hydrotheca is conical, almost as broad as long, about 0·7 mm. high by 0·5 mm. in greatest diameter, with a markedly oblique margin.

The gonangia are 2 mm. long by 0·6 mm. in diameter, narrowing slightly towards the opening, and considerably towards the base, where they are supported by a distinct peduncle. They are never grouped on the hydrocaulus.

Locality, etc.—Creeping over the fronds of *Macrocystis pyrifera*, Gough Island. Lat., 40° 20' S.; long., 9° 56' W. Date, 22nd April 1904.

Hebella striata, Allman, 1888. (Pl. I. fig. 7.)

Several specimens of the beautiful species described by ALLMAN in the Challenger Reports occur creeping on the stems and branches of various larger Hydroids. The hydrothecæ are large, almost 1 mm. in length by from 0·22 to 0·25 mm. in diameter, cylindrical, borne on short, untwisted peduncles varying in length from 0·25 to 0·4 mm. In some the characteristic ringing exists only on the lower half of the wall, part towards the margin being smooth. The hydranths are in all cases contracted, and in this state occupy only the lower half of the hydrotheca. They are in good condition, and show in their contracted state a bulging body, separated from a fleshy disc at the base of the hydrotheca by a marked constriction, and surmounted by another constriction from above which arises a whorl of tentacles. Within the tentacles there arises a conical hypostome.

Gonosome.—Not present.

Locality, etc.—Creeping on the stems and branches of *Lafôëa gracillima*, *Grammaria magellanica*, *Sertularella filiformis*, Burdwood Bank. Lat., 54° 25' S.; long., 57° 32' W.; 56 fathoms. 1st December 1903.

Hebella striata, var. *plana*, n. var. (Pl. I. Fig. 8.)

A colony creeping upon *Halecium robustum*, whose habit and general appearance resemble those of *H. striata*. The hydrothecæ, however, are rather larger, 1·3 to 1·4 mm. in length by 0·28 mm. in diameter, and show no hint of the annular thickenings of perisarc which form the characteristic striations. Marginal reduplications were noted in some cases, while a solitary peduncle was marked by a thickened ring near its base.

Gonosome.—Not present.

Locality, etc.—Creeping on the stems and branches of *Halecium robustum*, from Station 411. Lat., 74° 1' S.; long., 22° 0' W. Depth, 161 fathoms. Surface temperature, 28°·9. 12th March 1904.

In none of the true *H. striata* colonies did there occur hydrothecæ with more than about a third of their surface smooth, the remainder of course being striated, and even these were exceptional. Hence an entirely smooth hydrotheca seems worthy of being considered a distinct variety.

Calycella syringa, Linnæus, 1758.

Arising from a tubular, creeping stolon are several minute, extremely delicate, almost campanulate hydrothecæ whose cavities are separated from those of their peduncles by thin partitions. They are operculated, and are borne on peduncles of variable length which are always marked by many strong annulations.

The absence of gonosomes and the unsatisfactory state of the hydranths render accurate identification impossible, but the trophosome agrees with Hinks's (1868) description of *C. syringa*, except in that the "horn-colour" is lacking.

Measurements.—Hydrotheca: length, including operculum, 0·2 mm.; diameter, 0·1 mm. Peduncle: length, 0·2 mm.

Locality.—Burdwood Bank. Lat., 54° 25' S.; long., 57° 31' W. 56 Fathoms. 1st December 1903.

Family LAFOËIDÆ.

Lafôea antarctica, Hartlaub, 1904.

The above species occurs on the stems and branches of *Sertularella filiformis*. It agrees in all respects with the description given by HARTLAUB. The large number of the regeneration rings on the hydrothecæ is especially noticeable—six being not unusual. The length of the hydrothecæ, from where they leave the stem at right angles, to the margin, averages 5 or 6 mm., while the diameter is about 1·25 mm.

Locality, etc.—Creeping on the branches of *Sertularella filiformis*, from Burdwood Bank. Lat., 54° 25' S.; long., 57° 32' W. Fathoms, 56. Date, 1st December 1903.

Previous Locality.—70° 23' S.; 82° 47' W.

Lafoëa gracillima (Alder, 1857).

Several specimens referable to this species occur growing on the horny axis of an Alecyonarian. They agree in all but size with the specimens described by BONNEVIE (1899), the largest reaching a height of only 3 cm., while the general size lies between 2 and 3 cm. The colonies are erect and branched, without any distinct stem, the greater number of the branches lying in one plane and showing a tendency to be more strongly developed on one side. Except towards the tip, where they are monosiphonic, the branches are fascicled. The hydrothecæ are long narrow cylinders 0.5 mm. in length by 0.1 mm. in greatest diameter, sometimes with reduplication rings round their margins. They arise irregularly from all sides of the hydrocaulus, and are borne on loosely twisted peduncles bearing two turns of a spiral.

Gonosome.—Not observed.

Locality, etc.—Growing on the axis of an Alecyonarian (Gorgonid) in 56 fathoms. Date, 1st December 1903. Burdwood Bank. Lat., 54° 25' S.; long., 57° 32' W.

Grammaria magellanica, Allman, 1888. (Pl. I. figs. 4, 4A.)

Three colonies varying in height from 6 cm. to 16 cm., and in breadth from 7 cm. to 12 cm. The stem is fascicled and thick, reaching just above the base a diameter of about 3 mm. and gradually tapering towards its summit. In two of the specimens it divides about 1 cm. above the base into two or three equally developed, strong branches, and these, together with the stem itself in the other specimen, bear along their length usually alternate ramuli, which sometimes reach a length of 14 cm. These primary ramuli bear secondary, and these again may bear tertiary, pinnæ-bearing branches. On all the branches, and on the main stem between the branches, there are alternately-set pinnæ usually between 10 mm. and 15 mm. in length, which become greatly constricted at their point of origin. All the branches and pinnæ lie in one plane, and in the largest specimen anastomosis occasionally occurs between them. The hydrothecæ are placed in successive planes, in whorls of three, which alternate with one another so that there are six longitudinal rows on the colony. They are cylindrical, and have a circular opening with an even, non-everted margin.

Gonosome.—The gonangia are grouped together into irregular bunches which surround portions of the stem and the bases of such branches as arise from these portions. In the largest of the three colonies two bunches of clustered gonangia were found, the larger 30 mm. long by 3 mm. in diameter, the smaller 20 mm. long by about 2 mm. in diameter, while on another colony a still smaller cluster occurred. These coppiniæ are elongated clusters of compressed gonangia growing closely around the stem for a considerable distance, and bristling with minute projecting tubes which are without the irregular bendings figured by HARTLAUB (1905). Under the microscope the cluster resolves itself into a large number of hexagonal cells, closely resembling honey-

comb—the compressed gonangia—from among which spring many short, uncoiled tubes 0·4 to 0·5 mm. in length.

Locality.—Burdwood Bank. Lat., 54° 25' S.; long., 57° 32' W. Depth, 56 fathoms. 1st December 1903.

As the species was named by ALLMAN from small fragments, and as subsequent specimens collected by PAESSLER in 1893 off Australia were also fragmental, I have thought it necessary to give a rather full account of the structure of the colony to supplement the original description. Since HARTLAUB figures only longitudinal and transverse sections of the coppinia (HARTLAUB, 1905, p. 597), representations of the general appearance and magnified surface view have been here included.

Brucella, nov. gen.

We have named this genus after Mr BRUCE, the leader of the expedition.

Generic Characters. Trophosome.—Stem and branches fascicled for the most part, becoming monosiphonic distally; consisting of an axial tube predominantly hydrotheca-bearing, surrounded by peripheral tubes which may occasionally bear hydrothecæ and nematophores. Hydrothecæ tubular, fastened by their bases to a process of the hydrocaulus, their cavity being distinctly differentiated from that of the peduncle. Each hydrotheca is accompanied by a basal pair of nematophores.

Gonosome.—A coppinia, that is, a bunch of clustered gonangia surrounding the hydrocaulus, from which a number of delicate tubes arise.

The genus shows affinities with *Perisiphonia*, Allman (ALLMAN, 1888, p. 43) and *Zygophylax*, Quelch (QUELCH, 1885, p. 4). From the former it can be distinguished by its manner of fascicling, its arrangement of nematophores, and, perhaps not so certainly, by the shape of the hydrothecæ. The chief points of difference are summarised in the following table:—

<i>Perisiphonia</i> .	<i>Brucella</i> .
Axial tube completely enveloped.	Axial tube not completely enveloped.
No hydrothecæ on peripheral tubes.	Scattered hydrothecæ on peripheral tubes.
Nematophores frequent and regular on peripheral tubes.	Nematophores scattered and irregular on the peripheral tubes.
Nematophores present or absent from axial tube.	Two nematophores at base of each hydrotheca on axial tube.
Hydrothecæ flask-shaped.	Hydrothecæ tubular.

From *Zygophylax*, to which it is closely allied, it can readily be distinguished by the distinct differentiation of the hydrotheca cavity from that of the peduncle, and by the scattered nematophores on the peripheral tubes.

A portion of a specimen when softened in caustic potash and dissected, showed a central, predominantly hydrotheca-bearing tube, surrounded by peripheral tubes, which were sometimes simple, sometimes branched, and sometimes bearing scattered hydrothecæ and nematophores. The structure of the fasciculation seemed to resemble that

in *Sertularella gayi* as described by NUTTING, 1904, p. 6, although I found difficulty in tracing the peripheral tubes to their origin. The peripheral tubes certainly never become hydrotheca-bearing to the same extent as in *Sertularella gayi*.

The characters of the trophosome, and especially of the gonosome, appear to indicate close relationship with the Lafoëidæ, in which family the genus has accordingly been placed.

Brucella armata, n. sp. (Pl. II. figs. 2A, 2B, 2C.)

Several specimens have been obtained of a colony for which the above new genus has been formed. The colonies, which are erect and much branched, with both stem and branches thickly fascicled, reach in some cases a height of 6 cm. by a similar breadth. Owing to this great breadth, as compared with height, and to the fact that the many branches lie in one plane, the colony assumes a somewhat flabellate appearance. It is of a pale brown colour, becoming lighter towards the tips of the branches. Except distally, where for a short distance they become monosiphonic, the stem and branches are fascicled, consisting of an axial tube, predominantly hydrotheca-bearing, surrounded by peripheral tubes which may bear occasional hydrothecæ and scattered nematophores. The main *branches*, which may reach a length of 5 cm., leave the stem at irregular intervals, although frequently there is an approximation to alternate arrangement, while those borne by the main branches are regularly pinnate and alternate and are rarely branched. All the branches lie in one plane, and arise from below a hydrotheca, which then lies in the axil of the branch. The cavity of the axial tube is continuous; the tube is not divided into internodes, but bears alternately at regular intervals small processes to which the hydrothecæ are attached. The *hydrothecæ* are biserial, alternate, tubular, with an entire margin which is not parallel to the axis of the hydrocaulus. Their upper side is curved, while the lower is almost straight, and their cavity is cut off from that of the rest of the colony by a strong septal ridge at their junction with the hydrocaulus process. Above this occur one or two delicate, membranaceous intrathecal septa apparently stretching across the cavity of the hydrotheca, while near the edge there are usually two or three lines indicating the presence of marginal reduplications. The length of the hydrothecæ from basal septum to margin is between 0·3 and 0·35 mm., while the greatest diameter is from 0·13 to 0·15 mm. Towards the base they become constricted and rest upon a short process of the hydrocaulus, from each side of which springs a nematophore. The *nematophores* are small, only 0·1 mm. long by 0·04 mm. in diameter, and resemble those found in some of the Eleutheroplean Plumularians, consisting of two joints, the proximal, a narrow tube, the distal, a wider tube opening out slightly towards the margin, round which there is frequently a reduplication line. This whole two-jointed structure is sometimes loosely incased in an unjointed tube. Scattered nematophores of similar structure occur frequently but irregularly on the peripheral tubes. The form of the hydranth could not be distinguished.

Gonosome.—On one specimen were found two clusters of gonangia, the larger measuring 5 mm. in length by 3 mm. in diameter, the smaller 5 mm. by 2 mm. The clusters or coppinæ form elongated ovals surrounding the stem and the bases of branches in the neighbourhood. They consist of numerous gonangia so closely packed that the sides become compressed and the whole assumes a honeycomb-like structure consisting of a dense mass of polygonal, usually hexagonal, cells, the majority of which communicate with the exterior by an exceedingly short tube. Issuing from this gonangial cluster are frequent tubes of various shapes; a few, especially at the ends, are merely two-jointed tubes like cauline nematophores with their basal joint elongated, while the majority consist of a longer tube 1 mm. in length bearing alternate biserial nematophore-like bodies identical in structure with the nematophores on the trophosome.

Locality, etc.—Growing on the axis of an Alcyonarian (Gorgonid), and dredged off Gough Island, lat. $40^{\circ} 20' S.$, long. $90^{\circ} 56' W.$, at a depth of 100 fathoms. Date, 22nd April 1904.

The colonies were growing on the horny axis of a Gorgonid Alcyonarian, and appear to have been lying untenanted for some time, for not only has the coenosarc almost wholly disappeared, but foraminifera frequently occur within the hydrothecæ, while barnacles and polyzoa, including a beautifully ringed, snake-like form, *Anguinaria spatulata*—a rare British species—occur growing on the colony.

Family SERTULARIIDÆ.

Sertularella arborea, Kirchenpauer, 1884.

This species is represented by some colonies growing on lamellibranch shells, the largest reaching a height of 8 cm. The specimens possess the characteristics described by HARTLAUB (1900):—Compound stems and branches; branches pinnate and alternate, arising beneath a hydrotheca and divided by slanting nodes into very short, stout internodes, each of which bears a hydrotheca; hydrothecæ adnate for about two-thirds of their length, with walls of unequal thickness and hints of *intracalcine teeth*; margin divided into four small, equal teeth. Gonotheca very long (about 3 mm.) and narrow, often smooth, sometimes with faint signs of ringing, usually bearing at the distal end four minute teeth, and always arising from between the internode and the side of the hydrotheca near the margin. The specimens show no variations which have not been noted by HARTLAUB (1900).

Locality, etc.—Entrance to Saldanha Bay, Cape Colony; 25 fathoms. Date, 21st May 1904.

Sertularella contorta, Kirchenpauer, 1884.

Several specimens of this species have been obtained from two localities. They are bushy colonies reaching to a height of slightly over 7 cm., almost destitute of branches

near the base, but profusely branched distally. Except in the following unimportant details, the specimens agree with those previously described. While the annulations at the bases of the branches are well marked, the constrictions in the internodes are neither so frequent nor so distinct as those of former specimens. The gonangia closely resemble those described and figured by NUTTING (1904, p. 85). The annulations vary in number, in some cases disappearing altogether in the proximal portion of the gonangium. The teeth at the summit of the gonangium also vary in number; sometimes they seem to be absent, as in KIRCHENPAUER's specimen (1884), sometimes two are present, as described by NUTTING, but in the present specimens three is also an occasional number.

Localities.—(a) Falkland Islands, Port Stanley. Date, 8th January 1903. (b) Cape Pembroke; shore. January 1903 to January 1904.

It is interesting to note that the present specimens were found in the same locality as were those from which the original description of the species was made by KIRCHENPAUER some twenty years ago.

Sertularella filiformis, var. *reticulata*, n. var.

Several colonies referable to this species have been found, usually growing on polyzoon crusts, in two localities. Of the colonies, which are profusely branched and loaded with gonangia, those from locality (a) reach a height of from 5 to 6 cm. while those from (b) are considerably smaller. The hydrothecæ are adnate to the stem for 0.27 mm. and free for 0.15 mm., while at the opening their diameter is 0.15 mm. They have three teeth, thus differing from ALLMAN's (1888) description, where two broad cusps are mentioned, and agreeing with NUTTING's (1904) description of a portion of ALLMAN's specimen. The present specimens vary slightly from those described by NUTTING in habit and in gonangia. The majority of those from (a) and all the specimens from (b) have closely interwoven and anastomosed branches, and thus present a matted, net-like appearance.

Gonosome.—The gonangia arise from each side of and just below the hydrothecæ. They are top-shaped, 1.7 mm. long, with eight or nine large annular ridges, the widest portion occurring about the second or third ridge from the distal end, where the diameter, not including the ridge, is 0.7 mm. They are surmounted by a tube 0.45 to 0.5 mm. long, whose diameter gradually increases from base to margin, where it is 0.25 mm. wide.

Localities, etc.—(a) Burdwood Bank. Lat., 54° 25' S.; long., 57° 32' W.; 56 fathoms. Date, 1st December 1903. (b) Eight miles north of Dassen Island, Cape Colony; 35 fathoms. 18th May 1904.

Sertularella gayi, Lamouroux, 1821.

A strongly fascicled specimen 13 cm. high by 7 cm. broad is referable to this species. The general habit of the colony, with rigid stem 2 mm. in diameter

just above the base, and monosiphonic, roughly pinnate ramuli, is typical. The hydrothecæ are free distally for rather less than half their length, the free portion standing out from the stem almost at a right angle, and being marked on the upper side by a few rather indistinct annular rugosities.

Gonosome.—Not present.

Locality, etc.—Depth, 100 fathoms. Off Gough Island. Lat., 40° 20' S.; long., 9° 56' W. Date, 22nd April 1904.

Sertularella tenella (Alder, 1857).

Small specimens of this delicate colony some 7 mm. long have been found growing on *Synthecium robustum*. They are quite typical in appearance, agreeing with previous descriptions and figures.

The following are average measurements :—

Internodes.—Length from 0·55 to 0·8 mm.

Hydrothecæ.—Length, 0·5 mm.; widest diameter, 0·25 mm.; diameter at margin, 0·15 mm.

Gonosome.—Not present.

Locality, etc.—From off Burdwood Bank, lat. 54° 25' S, long. 57° 32' W., at a depth of 56 fathoms. Date, 1st December 1903.

Sertularella tricuspidata (Alder, 1856).

A slender, pinnately branched colony 7 cm. high. It lacks the profuse branching and matted appearance of a typical specimen of *S. tricuspidata*, but in other respects it agrees closely with the specific description.

Average Measurements.—Internodes: length, 0·75 mm. Hydrothecæ: height, 0·6 mm.; portion adnate, 0·35 mm.; portion free, 0·4 mm.; diameter at margin, 0·3 mm.

Gonosome.—Not present.

Locality, etc.—From off Burdwood Bank, lat. 54° 25' S., long. 57° 32' W., at a depth of 56 fathoms. Date, 1st December 1903.

Sertularella rectitheca, n. sp. (Pl. I. fig. 5.)

A small, delicate colony some 9 mm. high, growing on the stem of *Staurotheca reticulata*. The stem is slender and unbranched, divided for some distance by slanting nodes into short regular internodes 0·5 mm. long, and produced distally into a tubular tendril-like process which was attached to a portion of the *Staurotheca* colony. The internodes are much broadened half way up their length by a shoulder for the support of the hydrothecæ. These are alternate, cylindrical, about 0·5 mm. high by 0·15 mm. in diameter, adnate up to the distal end of the internode in which they arise, then free for the remaining third of their length. The hydrothecæ are straight, the free portion

being in the same line as the adnate, the whole axis lying practically parallel to the stem. The margins of the hydrothecæ are divided into three teeth, a small one on the adcauline edge, and two large and equal ones on the margin remote from the stem. The number of flaps in the operculum could not be counted.

Gonosome.—Not present.

Locality, etc.—Growing on *Staurotheca reticulata*, Scotia Bay, South Orkneys. Depth, 65 fathoms. Date, 25th March 1903.

Thujaria pectinata, Allman, 1888.

A single specimen some 6 cm. high almost completely enveloped in a dense polyzoon growth. The stem is unbranched and monosiphonic about 1 mm. across, and is divided into equal internodes, each of which bears three pairs of opposite hydrothecæ. A pair of opposite pinnæ arise from each internode, originating between the proximal and median pairs of hydrothecæ. On the pinnæ the nodes are quite distinct, being marked by a constriction (in ALLMAN's figure they are scarcely indicated), and the hydrothecæ are arranged as on the stem—three pairs to each internode. The hydrothecæ are so closely approximated that the top of one touches the base of the next, but the “free membranaceous extension of the wall” has in every case been destroyed, leaving a rather ragged edge level with the general outline of the pinna. One of the pinnæ, instead of being thecate to the tip, was produced into a long, tubular, tendril-like process.

Gonosome.—Not present.

Locality.—Dredged at the entrance of Saldanha Bay, Cape Colony, in 25 fathoms. Date, 21st May 1904.

Synthecium robustum, Nutting, 1904. (Pl. I. fig. 6.)

About half-a-dozen specimens of this species have been dredged from the locality of Burdwood Bank. The average height is about 7 cm., but two specimens are 11 cm. high by 4 cm. broad, almost twice the size of the specimen described by NUTTING. The branches, which are regularly opposite, are simple in the majority of the specimens, but in some they rarely bear opposite branchlets; and not only in these branchlets, but even in the branches themselves, there is a distinct narrowing of the perisarc immediately above each pair of hydrothecæ. The hydrothecæ have frequently one or two annular striations—lines of reduplication—round their margins. Except in these details the trophosome agrees with NUTTING's description.

Gonosome.—The gonangia differ somewhat from the dried specimens originally described. They are top-shaped, 2 mm. long by 1 mm. in diameter at the widest part. Distally they are strongly annulated, proximally they are almost smooth, while they are terminated by a low dome, the tubular neck of the original specimen being unrepresented.

Locality, etc.—Burdwood Bank. Lat., $54^{\circ} 25' S.$; long., $57^{\circ} 32' W.$ Depth, 56 fathoms. 1st December 1903.

The occurrence in these specimens of branches sometimes simple and sometimes bearing pinnately arranged branchlets, appears to indicate that this character, upon which HARTLAUB founded his *S. chilense* (1905, p. 671), is rather a variation than a character of specific value.

Staurotheca, Allman, 1888 (modified).

Generic Character. Trophosome.—Hydrocaulus fascicled or unfascicled, bearing hydrothecæ in longitudinal rows and arranged in a series of transverse planes, each plane containing two or three hydrothecæ which exactly alternate with those in the planes above and below them.

Gonosome.—Gonangia simple capsules springing from the hydrocaulus and destitute of marsupium.

This genus, as described by ALLMAN, must be slightly modified to include the specimen described below. The alternate arrangement of the successive series of hydrothecæ remains constant, but the generic characters must be widened to include not only opposite hydrothecæ, but also hydrothecæ arranged in whorls of three.

Staurotheca reticulata, n. sp. (Pl. I. figs. 1, 1A, 1B.)

A portion of a branched hydroid colony 8 cm. in length by 4 cm. in breadth. The stem, which is 0.5 mm. in diameter, is unfascicled, and from it arise, at fairly regular intervals of 5 mm., alternate flexuous branches of the same thickness as the stem, which zigzags between their bases. Smaller branches arise from these main branches and anastomose so frequently, sometimes by means of short, tendril-like processes, that free ends are absent except towards the margin of the colony. In some cases the free ends develop hydrorhizal tubes. All the branches lie in one plane, and this, together with the flabellate form of the colony and the prevalent anastomosis, gives the whole a remarkable net-like appearance, the regularity of the meshwork, at least near the stem, being increased by the fact that the main branches on each side of the stem lie roughly parallel. The internodes are irregular, generally containing about three pairs of hydrothecæ in the older branches, while in the younger there is usually a hint of a node between each pair.

The hydrothecæ are placed in longitudinal rows along the stem and branches. In the majority of the branches there are four rows, the hydrothecæ being arranged in opposite pairs, which are placed alternately at right angles with one another. Sometimes there are six rows—the hydrothecæ in this case being placed in a succession of transverse planes, each plane containing three equidistant hydrothecæ, which exactly alternate with those in the planes immediately above and below them. The hydrothecæ themselves are cylindrical and deep, with a circular orifice and a smooth margin marked

sometimes by one or two lines of growth. They are 0·5 mm. in height, and for 0·4 mm. of this distance they are adnate, the free portion curving outwards from the stem.

Gonosome.—The gonangia are ovoid, 0·7 to 0·8 mm. long, and 0·45 mm. in diameter at the widest part, narrowing proximally and terminated distally by a circular orifice at the end of a short bulging prominence. They lie closely apposed to the stem for the greater part of their length, but can easily be detached, and arise on each side of, and just below, a hydrotheca. Thus although one or two gonangia most commonly occur at one level, the full complement at a plane containing a pair of hydrothecæ is four, two to each hydrothecæ.

The colony is of a horn brown colour.

Locality, etc.—Obtained from a gripper on a sounding wire from Scotia Bay, South Orkneys. Depth, 65 fathoms. Date, 25th March 1903.

Family PLUMULARIIDÆ.

Aglaophenia dichotoma (Johns.), Kirchenpauer, 1872. (Pl. III. figs. 2, 2A, 2B, 2C.)

A large number of branched, fan-shaped colonies, 10 cm. high by about 7 cm. broad, with monosiphonic stems. The following details supplement KIRCHENPAUER'S rather meagre description:—The branching, which is characteristic, is strictly dichotomous. The stem and branches are divided into short regular internodes 0·3 mm. long, and from a nematophore-bearing process on each of these a hydroclade arises. The *hydroclades*, which are alternate and closely approximated, are borne on the front of the stem and leave it at an angle of about 45°. They also are divided into short regular internodes 0·3 mm. in length, each with two strong septal ridges extending almost around their walls, one opposite and in line with the intrathecal septum, the other at the level of the bases of the supracalyceine nematophores. The *hydrothecæ*, which are closely approximated and obconical, are tilted forward from the stem, the distal portion apparently being free. Their margin, which is not expanded or flaring, is divided into nine teeth, the anterior three being slightly larger and sharper, the middle one bent a little backwards. The intrathecal ridge is strong and oblique, in the same line as the corresponding internodal ridge, and reaching to the opposite wall of the hydrotheca. The supracalyceine *nematophores* are not quite tubular. They are large and bulging, but do not reach to the margin of the hydrotheca, while the mesial nematophore, which is extremely narrow near the base but becomes wider distally, just reaches the level of the margin, the distal third of its length being free. The process arising from the stem and branch internodes, upon which the hydroclades are borne, bears about five nematophores similar in structure to those on the hydrotheca. The arrangement also is similar, one being median and proximal, while two are lateral and near the distal end of the process, but there are in addition a lateral and a basal pair.

Gonosome.—The corbula is oval, flattened laterally, 2 mm. long by 1 mm. in

greatest diameter. It has five pairs of adnate costæ, each bearing from ten to twelve not quite tubular denticles along its length and an apparently unpaired, partly free, costa at the proximal end. On the corbula peduncle there is one hydrotheca.

Locality, etc.—The colonies were growing on a sponge, and were dredged at the entrance to Saldanha Bay, Cape Colony, in 25 fathoms of water. Date, 21st May 1904.

Plumularia echinulata, Lamark, 1836.

Several colonies, the largest 3 cm. in height, were found growing on sponges in the same locality as *P. pinnata*. The specimens differ somewhat from the type described by HINKS (1868) but seem to form a connecting link between *P. echinulata*, type and *P. echinulata*, var. *pinnatoides* of BILLARD (1904, p. 191 *et seq.*). The following points indicate a close relationship to the latter:—Stem internodes in the proximal portions of the colony sometimes bearing two hydroclades, while in the distal internodes, and more generally throughout the colony, only one hydroclade per internode is the rule; intermediate internodes in the hydroclades absent in the specimens examined; supracalcine sarcostyle unprotected by a nematotheca, as described by HINKS; hydrothecæ deep; gonangia borne on stem. On the other hand, the fact that the margin of the hydrotheca does not reach the level of the succeeding node, and the presence of well-marked and frequent spines on the gonangia, indicate affinities with BILLARD's *type*.

The state of the material prevented observations on the condition of the axillary nematophores from being made.

Locality, etc.—Growing on sponges, coaling jetty, Cape Town Docks. May 1904.

Plumularia magellanica, Hartlaub, 1905. (Pl. III. fig. 1, 1A.)

The specimens collected by Mr BRUCE differ somewhat in the structure of their hydroclades from the specimens of this peculiar species described by HARTLAUB, but the difference is not of specific value. As in HARTLAUB's case, material is scarce.

The most complete colony is 15 mm. in height, and consists of a stem 0.15 mm. in diameter, divided by straight nodes into irregular internodes, each of which bears near its middle a single hydroclade. The *hydroclades* arise alternately from the stem nodes and are comparatively short—about 1 mm. They are set upon a small process of the stem, from which the first thecate internode is separated by a narrow, somewhat ring-like, athecate internode with slanting nodes. The thecate internodes are narrow at the base, and gradually widen distally until they finally seem to end in a rather shallow cup with expanded walls. From below this cup, and free from it, there arises in the distal portions of the colony a single short process, which bears again an expanding thecate internode from beneath whose hydrotheca another free process is given off, and so on, until each hydroclade bears from two to four or even five hydrothecæ. The

marked angle at which each thecate internode lies with regard to the one preceding it, gives these simple distal hydroclades a helicoid-cyme-like appearance. In the proximal hydroclades—and here our specimens differ from HARTLAUB'S—*two processes* arise below and at the opposite sides of the first hydrotheca, each of which bears a thecate internode, so that after the first hydrotheca the hydroclade possesses two diverging branches each similar to the simple distal hydroclades. Since the double hydroclades arise *laterally and not dorsally*, as HARTLAUB describes, from their internode, it follows that their origins lie in a plane at right angles to the plane of the primary stem processes. The *hydrothecæ* are shallow, with delicate, slightly expanded walls, and smooth margins. They appear to terminate the internode which bears them, are fixed only by their bases to their internode, and their walls are free. A single delicate, shovel-like nematophore lies in the centre of the internode beneath each hydroclade.

Gonosome.—Not observed.

The structure of the whole colony is extremely delicate. In some cases the hydrothecal and internodal walls collapsed in process of mounting for microscopic examination.

Locality, etc.—Growing on a sponge, Port Stanley, Falkland Islands. 3rd February 1904.

Previous Localities.—South of Tierro del Fuego and Island Pictou, Tierro del Fuego Archipelago.

Plumularia pinnata, Linnæus, 1758.

A number of colonies, the largest only about 4 cm. high, occur on sponges and on lamellibranch shells. The colonies agree with HINKS's description. The following variations were noted in the specimens:—Generally the number of hydroclades per internode is two, but on a number of the distal internodes only one hydroclade occurs. The presence of a basal athecate internode at the origin of each hydroclade, as described by BILLARD (1904, p. 204), was noted, but between the thecate internodes no intermediate athecate internodes were observed.

Gonosome.—While the proximal, and therefore the older, gonangia assumed the spinous form figured by HINKS (1868, Pl. 65), the distal, younger gonangia were somewhat cup-like, with a truncated appearance, due to the inversion of the topmost portion of the gonangium, which, at first inverted, apparently becomes everted in the later stages of growth.

Locality, etc.—Growing on sponges and on lamellibranch shells, coaling jetty, Cape Town Docks. May 1904.

Plumularia unilateralis, n. sp. (Pl. II. figs. 1, 1A, 1B, 1C.)

The specimens for which this species has been formed are small, averaging only 2 cm. in height, with simple recurved stems divided by slanting nodes into regular internodes, in general 0·4 mm. in length, but rather longer towards the base. From the

middle of each internode there arises a single hydroclade. In no case has more than one hydroclade per internode been seen. The *hydroclades*, which are set on short processes of the stem internodes, lie alternately in two planes, these planes being so set forward that the hydroclades appear to arise from only one side of the stem. They leave the stem at acute angles (30° to 45°), and are divided into equal internodes 0.25 mm. long, each of which bears a hydrotheca—one small triangular athecate internode separating the first thecate internode from the stem process. In some cases secondary hydroclades are developed from the side of a hydroclade internode at the level of the base of the hydrotheca. No internodal septæ are present, but the internode bulges proximally to form a support for the hydrotheca. The *hydrothecæ* are cup-shaped, moderately deep, even-rimmed, and for a short distance distally they are free from the internode. They are closely approximated, the margin of a hydrotheca being on a level with the succeeding node. *Nematophores* are absent from the stem, from the stem processes, and from the athecate internodes at the origin of the hydroclades, but one small, shovel-shaped nematotheca occurs in the median portion of the internode just below each hydrotheca, while in the angle between the hydroclade and the free rim of the hydrotheca is a median, unprotected sarcopore.

Gonosome.—Gonothecæ about 1 mm. in length occur in parallel rows along the stem, apparently arising on the inner side of the hydroclade-bearing processes. They are ovate, with somewhat flat tops, and are very shortly stalked. The gonothecæ are seldom smooth, the walls being generally strengthened by seven regular longitudinal ridges, which terminate distally in one or two more or less pronounced spines.

Locality, etc.—Growing on a sponge from the entrance to Saldanha Bay, Cape Colony; 25 fathoms. Date, 21st May 1904.

Antennularia hartlaubii, n. sp. (Pl. III. fig. 4, 4A, 4B.)

Colonies growing on a sponge in thick bunches, with thick fascicled stems which, about 1 cm. from the base, break up irregularly into smaller, still fascicled branches, these finally breaking up into long simple twigs. The latter are divided by straight nodes into regular internodes 0.5 mm. long, each of which bears three equally distant hydroclades so arranged that those on one internode exactly alternate with those on the internodes above and below, a hexastichous arrangement thus being produced. The *hydroclades* are borne on stout processes of the branch internodes 0.15 mm. long, and are divided into unequal internodes which are alternately long and thecate and short and athecate—two athecate internodes separating the first thecate internode from the supporting process. Sometimes, however, two athecate internodes are developed between a hydrotheca-bearing pair. Each internode is marked by two strong internal septa, one proximal, the other distal; but in the longer internodes two more are sometimes developed, one opposite the base of the hydrotheca, the other a little lower. The *hydrothecæ* are shallow, even-rimmed, resting on a broad ledge of the internode

and free for a short distance distally. The *nematophores*, of the usual trumpet-shaped type, have an internal septum which gives them a two-jointed appearance and are arranged as follows:—Three on each thecate internode, two lateral and distal, and reaching a considerable distance above the level of the hydrotheca margin, the other median and proximal and arising just above a slight bulge in the internode; one on each athecate internode, except where two such internodes are developed in succession, when the proximal one is unprotected; on the branches there are two lateral nematophores on the hydroclade-bearing process and one in the angle between this and the branch, but in the next highest internode.

Gonosome.—Not observed.

Locality, etc..—Entrance to Saldanha Bay, Cape Colony, in 25 fathoms. 21st May 1904.

The present specimens approach in general structure *A. decussata*, Kirch. (1876, p. 55), *A. johnstoni*, Kirch. (1876, p. 55), and *A. irregulares*, Quelch (1885, p. 8), for in the first and last of these the hydroclades, although generally two in number per internode, may vary from two to three or even four. In our specimens the hexastichous arrangement appears to be constant, and the species is distinguished from those mentioned above in having exceedingly strongly developed internodal septa.

We have named the above form after Professor CL. HARTLAUB of Heligoland, author of the report on the Belgian Antarctic Expedition hydroids, to whom we are indebted for occasional assistance.

Antennopsis scotiae, n. sp. (Pl. III. figs. 3, 3A.)

Two much weather-beaten colonies of a pale brownish colour, growing on a sponge fragment and reaching a height of 9 cm. and 4 cm. respectively. Both the colonies are badly weathered; the smaller is overgrown for half its length by the sponge, while the remaining portion is destitute of hydroclades. Here and there at irregular intervals a branch springs from the main stem, but without any definite arrangement. Of the larger specimen about 5 cm. are free from the encircling sponge, and on this almost bare surface a few hydroclades occur. The stem and branches are strongly fascicled, about 2 mm. in diameter, but the coenosarc shows no signs of caniculation (NUTTING, 1900, pp. 68 and 72). The *hydroclades* arise irregularly from all sides of the stem, springing from the outer tubes of the fascicle. Proximally they have from three to six athecate internodes separated by straight nodes, the distal of these, and sometimes that beneath it, being greatly elongated and bearing a number of nematophores varying from two per joint to five on a single long internode. Above this athecate portion the hydroclade is divided by alternate slanting and straight nodes into fairly regular internodes, every alternate one of which bears a hydrotheca. The *hydrothecæ* are stoutly campanulate and large, 0·22 mm. in length by 0·22 to 0·25 mm. in greatest diameter, with entire rim and oblique opening, adnate up to the distal end of their own internode, and afterwards free—the free portion lying over against the intermediate internode, the rim reaching the level of the proximal end of the next hydrotheca-

bearing internode. They are thus closely approximated. The *nematophores* have a widely expanded, trumpet-shaped mouth, and besides those already mentioned, there are three on each hydrotheca-bearing internode, one median and proximal, standing on a slight angle of the internodal perisarc, two lateral, each borne on a process which rests against the side of the hydrotheca. Only one nematophore occurs on each intermediate internode.

Gonosome.—Not observed.

Locality, etc.—Dredged at the entrance of Saldanha Bay, Cape Colony, in 25 fathoms. Date, 21st May 1904.

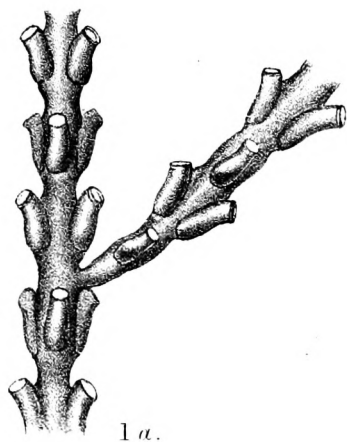
The general architecture approaches that of *Antennopsis fascicularis* (ALLMAN, 1883, p. 24), but there are differences in the proximity of the hydrothecæ and in the number and distribution of the nematophores.

We have named this species after the *Scotia*—the ship of the Scottish National Antarctic Expedition.

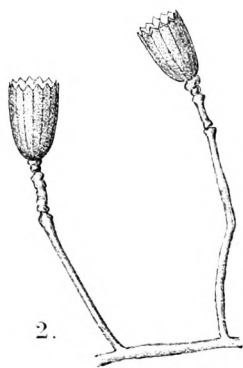
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RITCHIE. "SCOTIA" HYDROIDS. — PLATE I.



1 a.



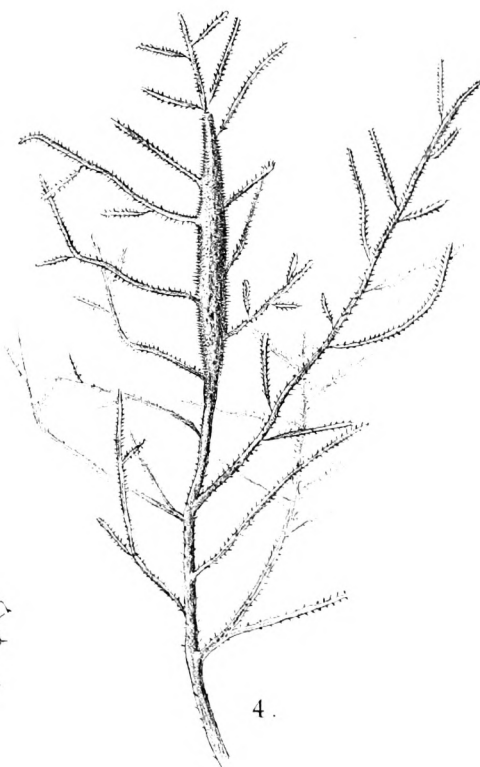
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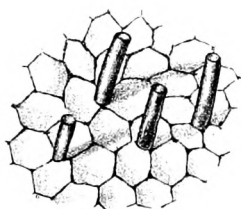
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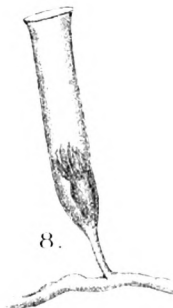
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3.



7.

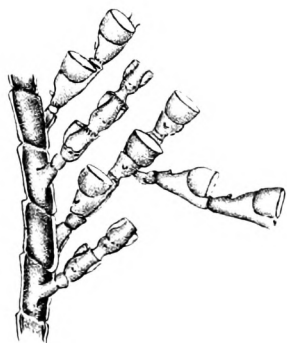


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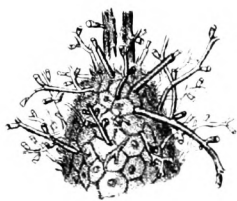


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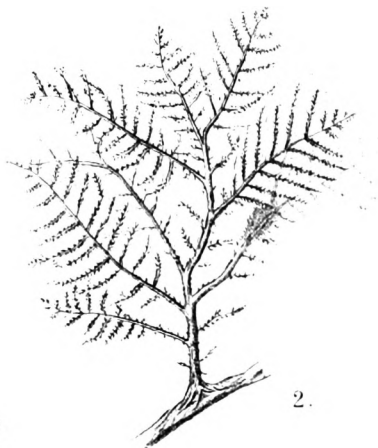
RITCHIE: "SCOTIA" HYDROIDS — PLATE II



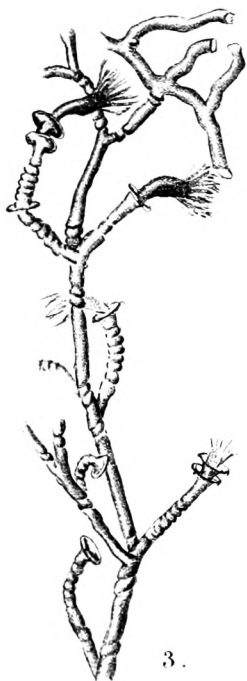
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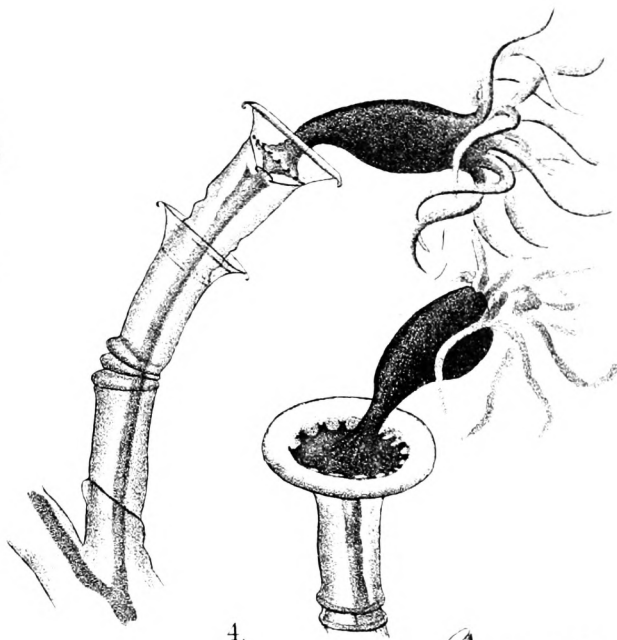
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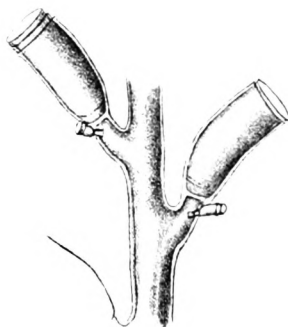
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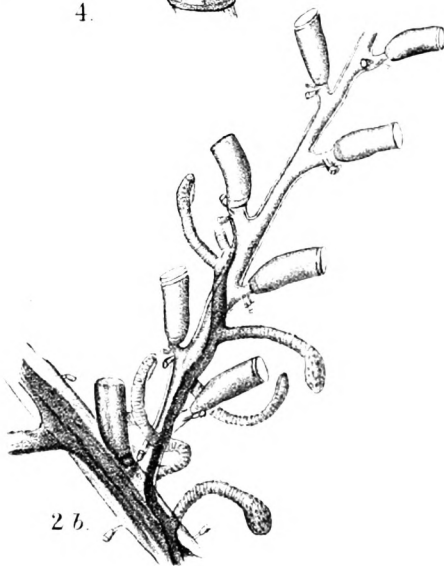
2 c.



1 b.



1.

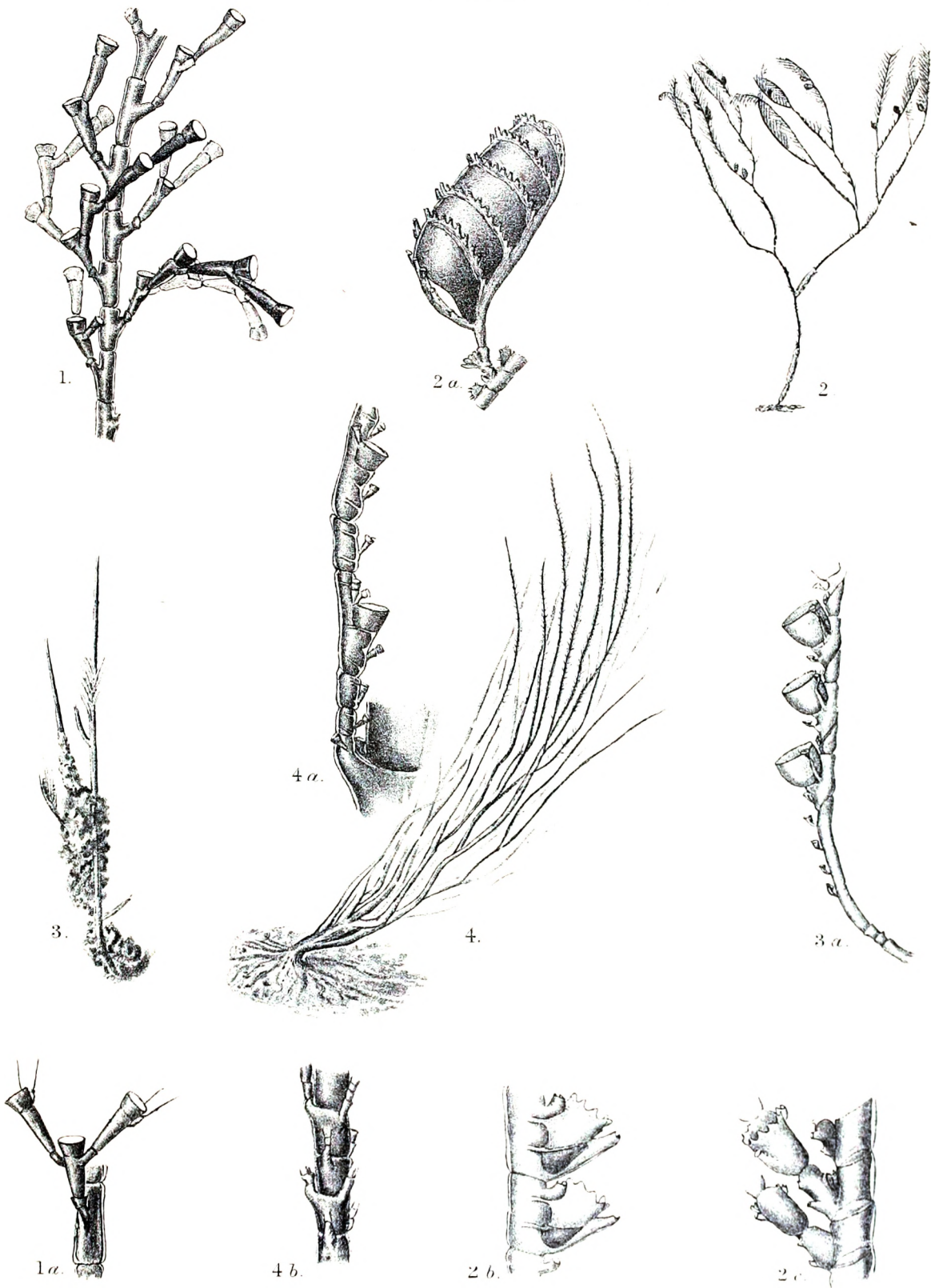


2 b.



1 c.

RITCHIE: "SCOTIA" HYDROIDS.— PLATE III.



EXPLANATION OF PLATES.

PLATE I.

- | | | |
|-----|---|---|
| 1. | <i>Staurotheca reticulata</i> , n. sp. | Nat. size. |
| 1A. | " " | Portion of stem and branch showing hexastichous and decussate arrangements of hydrothecæ. |
| 1B. | " " | Portion of branch with gonangia. |
| 2. | <i>Campanularia</i> , sp. | |
| 3. | <i>Halecium interpolatum</i> , n. sp. | Nat. size. |
| 4. | <i>Grammaria magellanica</i> , Allm. | Nat. size, showing gonosome cluster. |
| 4A. | " " | Surface of gonosome cluster. |
| 5. | <i>Sertularella rectitheca</i> , n. sp. | |
| 6. | ¶ <i>Synthericum robustum</i> , Nutt. | Gonangium. |
| 7. | <i>Hebella striata</i> , Allm. | Hydrotheca not completely ringed. |
| 8. | " var. <i>plana</i> , n. var. | |

PLATE II.

- | | | |
|-----|---|--|
| 1. | <i>Plumularia unilateralis</i> , n. sp. | Nat. size, growing upon a sponge fragment. |
| 1A. | " " | Stem with hydroclades. |
| 1B. | " " | Gonangia. |
| 1C. | " " | Portion of hydroclade with hydrothecæ. |
| 2. | <i>Brucella armata</i> , n. gen. et sp. | Nat. size, showing coppinia cluster. |
| 2A. | " " | Surface of coppinia cluster. |
| 2B. | " " | Portions of a fascicled and an unfascicled branch, with a creeping polyzoon— <i>Anguinaria spatulata</i> . |
| 2C. | " " | Hydrothecæ. |
| 3. | <i>Halecium interpolatum</i> , n. sp. | Branch, with hydrothecæ, ending in stolons. |
| 4. | <i>Halecium tenellum</i> , Hinks. | Showing attachment of hydranth within hydrotheca. |

PLATE III.

- | | | |
|-----|---|---|
| 1. | <i>Plumularia magellanica</i> , Hart. | |
| 1A. | " " | Origin of a double hydroclade. |
| 2. | <i>Agluopenia dichotoma</i> (Johns.). | Nat. size. |
| 2A. | " " | Corbula. |
| 2B. | " " | Hydrothecæ. |
| 2C. | " " | Portion of stem, showing origin of hydroclades. |
| 3. | <i>Antennopsis scotiæ</i> , n. sp. | Nat. size, partially encircled by a sponge. |
| 3A. | " " | Hydroclade with hydrothecæ. |
| 4. | <i>Antennularia hartlaubii</i> , n. sp. | Nat. size. |
| 4A. | " " | Hydroclade with hydrothecæ. |
| 4B. | " " | Stem showing hexastichous arrangement of hydroclades. |

II. *Note on Primnoa reseda from the Færoe Channel, and on its Embryos.* By Professor J. ARTHUR THOMSON, M.A. [With Two Plates.]

(Read 26th November 1906.)

A remarkably fine specimen of *Primnoa reseda*, Pallas, which used to be called the sea-mignonette, was obtained from the Færoe Channel (from a depth of 355 metres) in June of this year by the "Goldseeker," one of the vessels engaged in the International Exploration of the North Sea. Through the courtesy of Professor D'Arcy W. Thompson, C.B., I was able to see the splendid specimen a few days after capture, when the vessel came into port, and he has also given me permission to make this short note. The species—the only representative of the genus *Primnoa*—has long been known, but an examination of the beautiful specimen in its fresh state has revealed some new facts of interest, *e.g.*, as to the colour and the mode of reproduction. As one of the most gorgeous animals within the British area, it deserves some re-description in English, and a better figure than it has hitherto obtained.

The specimen was brought to the surface with its axis caught in a cleft in one of the boards of the trawl, and though without basal attachment, it was otherwise almost undamaged. It is almost a yard in height (34 inches), and its branches spread out for 16 inches. It far surpasses the specimen in the British Museum.

The axis, where bared at the base, has a diameter of $\frac{7}{16}$ ths of an inch, and the average breadth of the branches, including the covering of polyp-calyces, is $\frac{3}{8}$ ths of an inch. The colour of the colony, which soon began to fade, was *a brilliant salmon-pink*—a fact which I have not found mentioned in any of the descriptions. Some fragments which I preserved are now creamy white. The bare part of the axis at the base was a fine greenish-bronze, with a metallic lustre. In a class famous for beautiful representatives, *Primnoa reseda* must be accorded a high place, alike for its graceful branching and for its richness of colouring, not to speak of the elegance of the individual campanulate polyps. In its fresh

state it was one of the most beautiful animals I have ever seen.

My study of *Primnoa reseda* has been rewarded by the discovery of the interesting fact that the species is *viviparous*, and I have included at the end of the paper some notes on the embryos.

By way of contrasting the "Goldseeker" specimen with others previously obtained, I may briefly refer to a few of the old descriptions.

Linné (1728) called it *Gorgonia lepadifera*, and summed it up in the expressive words, "floribus sparsis consertis reflexis campanulatis imbricatis." He compared the polyp-calyces to barnacles, and noted that they were shut in by eight valves. He spoke of the cortex as *albidus*, but this seems to be only the post-mortem colour.

Pallas (1766) called it *Gorgonia reseda*, and gave a good description, alluding, for instance, to the resemblance between the close-set, recurved calyces and the fruits of mignonette, and to the branches thicker than swan's quills. He also speaks of the colour of the cortex and calyx-scales as white, whereas it is a vivid salmon-pink in the fresh specimen. He gives its locality as "mare norvegicum et forte indicum," but the suggestion of the Indian Ocean was probably due to some mistake.

In 1786 Ellis and Solander described it as "the barnacle-bearing Gorgon" (*Gorgonia lepadifera*), and noted the dichotomous branching, the bell-shaped, scale-covered calyces, the minute whitish scales covering the flesh, and the bone-like axis. The size is given as usually 18 inches high (contrast the 34 inches of our specimen); the locality is stated as the coast of Norway, but the specimen figured came from Archangel. Attention is directed to the eight valves covering the mouth, which are compared to the scales on the head of the horned asp, *Coluber cerastes*. "In this *Gorgonia*, which is a fixt animal, the scales on the stem and branches, which do not move, are much of one form, differing greatly from those on the heads, which are always in motion, while the animal is alive and catching its food." The downward bent heads and mouths are compared to "some species of barnacles,"

just as others had compared them to fruits of mignonette (*cf.* Clusius, "Planta marina Resedæ facie"). The two figures given by Ellis and Solander are fairly good.

Esper (1794) devoted about eight pages to the "sea-acorn horny coral," realising that it occupied a position by itself. But he was entirely mistaken in his interpretation of the animal, imagining that he had to do with an axis like that of *Antipathes*, on which little creatures related to barnacles had settled down! Yet his description, partly based on those of Gunnerus and Baster, is very accurate, and, as his work is somewhat inaccessible, I may be allowed to make a few extracts in free translation. The barnacle-bearing Gorgon is confined to Norwegian coasts, and does not occur in Icelandic waters; a height of 6 to 8 inches is common, but a large specimen was $2\frac{1}{2}$ feet high; most of the branches are truncate, but some taper; the colour of the fresh axis is greenish, but it soon becomes brown; the axis is horny and stony, and covered by fine longitudinal lines; there may be forty-eight campanulate shells or "houses" on an inch; the colour when fresh is yellow, but it soon becomes dirty white; in most cases the mouths of the houses were towards the tips of the branches, but a few were turned in the reverse direction, and some were quite awry; the houses are formed of rows of imbricating brittle scales, with 6-8 parts making a lid; but the houses do not really belong to the coral, for while it is related to *Gorgonia antipathes*, they are related to barnacles (*Lepas*).

It was Lamouroux who first recognised the essential peculiarities of this type, separated it from Gorgonians, and established the genus *Primnoa*.

In the *Edinburgh New Philosophical Journal* for 1847, Charles Stokes wrote as follows:—"Primnoa lepadifera is found, I believe, only on the coast of Norway. I have specimens nearly 2 feet in height, which were presented to me by Sir Arthur de Capell Brooke, Bart., who collected them there in 1820. He received accounts of their growing to a much larger size. They are found at great depths, varying from 150 to 300 fathoms. At these depths they grow in company with a large branching Alcyonium of a red

colour (*A. arborea*).” The latter is now named *Paragorgia arborea*.

He goes on to say that “the polype cells of *Primnoa* are membranaceous and covered with calcareous scales, . . . these scales do not cover the whole surface of the cells; on the inner side, next to the stem, there is a part devoid of scales, as if, being less exposed, their protection was not needed. . . . The substance of the cells being membranaceous, they are movable in all directions, as is shown by the different positions in which the cells of *P. lepadifera* have dried, and hence a mistake was made by Ellis, who described the cells as ‘reflexed,’ that is, with the mouth downwards, which must have arisen from the position in which his specimens had been hung up to dry, as the weight of the cells would make them fall.”

As the “Goldseeker” specimen was, naturally enough, not “hung up to dry,” it may be interesting to note that while the great majority of the polyps were reflexed, a few among them had the mouth pointing upwards. They are so stiffly encased in scales that one finds it difficult to believe that they could possibly turn upon their bases of insertion. It is surely a growth-variation.

In his brief paper, Stokes refers to his figures of a *Primnoa rossii*, n. sp., which Sir James Clark Ross had obtained from a great depth (see his *Voyage to the Southern and Antarctic Regions*, vol. i. p. 334). This new species seems to have been left undescribed, but Dr J. Versluys notes in his splendid monograph on the Siboga Primnoidæ that it was perhaps the same as Gray’s *Hookerella pulchella*, which was also left practically undescribed. A specimen in the British Museum, labelled *Hookerella*, seemed to Versluys to agree closely with his *Thouarella tydemani*, but a comparison of the polyps was not made. Thus, so far as we know, *Primnoa reseda* remains the only species of its genus.

In 1861 E. Grube described “a new coral”—*Lithoprímnoa arctica*—from the Norwegian coast, in 70° N. lat. This is, again, *Primnoa reseda*, Pallas. I have not been able to consult Grube’s somewhat inaccessible paper, but there is a notice of it in the *Annals and Magazine of Natural History*

for 1863, p. 166. He describes the axis as greyish-white, whereas it was greenish-bronze in our specimen; he speaks of the concentric layers of lime amid the black cornein; and says that the calcareous scales on the bodies of the polyps and the eight oral valvules approximate it to *Primnoa lepadifera*, with which it is indeed identical.

It is interesting to notice that Verrill found *Primnoa reseda* in deep waters at St George's Bank in the Bay of Fundy. In the description which he gave in 1866, there are several points which disagree with what our specimen shows. He says: "Trunk large, arborescent, branching in a dichotomous manner, often very thick and stony near the base; branchlets round, tapering to slender flexible points; cells large, campanulate, irregularly scattered." But in our specimen the branching is only irregularly dichotomous, the branches do not taper to slender points, and the cells, though not in whorls or spirals, are closely crowded, and cannot be spoken of as scattered. Verrill also says that "the cells are capable of moving in different directions, but in preserved specimens are generally turned downwards." As already noted, we cannot believe in much mobility of the polyp-calyces.

Gray's description also leaves a good deal to be desired. He refers to "the large basins or cups of the shape of bent reeds, membranous on the concave side, on the convex side covered with large imbricated overlapping scales. At the mouth of the cup the scales form a ring, and are eight in number, within which, in the retracted polypes, there is a coniform outstanding lid, which is formed out of eight long flat scales. Besides, the polypes at the base of the branches possess eight rows of small calcareous bodies (spicula), and indeed, small out-pressed double clubs, covered with small warts and spines, approaching to simple spicules." He defined the species as "a coral alternately branched, diffused; bark with crowded, callous, recurved calyces."

In his diagnosis of the genus *Primnoa*, Gray says: "Coral branched, tree-like; branches cylindrical, forked. Bark formed of scales. Polypiferous cells ovate, clavate, dependent, covered with two series of large convex imbricate

scales, placed in whorls of three round the branches." But they are characteristically *not* in whorls in *P. reseda*, the only known species. The aperture, he says, is closed with *three* pointed scales, yet he himself points out that *P. reseda* has *eight*. "The axis is horny [really very calcareous as well], black [really burnished green-bronze], solid, cylindrical, the base being often covered with a hard calcareous longitudinally striated outer coat."

In his monograph on the Primnoidæ—a model of thorough and thoughtful workmanship—Dr J. Versluys abstains from a re-description of *Primnoa reseda*, because it is so readily recognisable. He gives the following diagnosis:—"The polyps may be closely apposed to the twigs, as in *Caligorgia*, by their almost naked adaxial surface; only two abaxial rows of sclerites are well developed. At the upper margin of the calyx there are eight sclerites, each of which bears an opercular scale, and of these, as of the sclerites which bear them, the four adaxials are distinctly smaller than the four abaxials." "The branching is irregularly dichotomous, and relatively sparse. The colony spreads out, predominantly but not exclusively in one plane. The polyps are not in verticils, but are disposed irregularly and somewhat densely; they are not in spirals."

Geographical Distribution.—Versluys sums up the distribution of *Primnoa reseda* as: North Atlantic, coasts of Scotland, Shetland Islands, Norway, White Sea, and on the American coast at St George's Bank, Bay of Fundy. Stokes says off Norway; and the British Museum specimen, presented by Dr Carruthers, is from the same region. The specimen described and figured by Ellis, presented to him by Solander, came from Archangel. Gray notes North Sea; Setubal (Prof. E. P. Wright); England (Johnson). In his *British Animals* Fleming notes, "This species, which is common on the Norwegian coast, has been found, according to Professor Jameson (*Wernerian Memoirs*, vol. i. p. 560), at Zetland and Aberdeenshire." We have now to add, Færoe Channel.

Embryos.—As I have mentioned, my study of *Primnoa reseda* has been rewarded by the discovery that this species

is *viviparous*. Another form must therefore be added to the growing list of Alcyonarians in which viviparity has been demonstrated (see Thomson and Henderson in the list of References).

Many of the polyps in the fragments at my disposal were found to be crowded with embryos, but most of them were unfortunately at the same stage of development. As we have very few data in regard to the development of Alcyonarians, except the memoirs of G. von Koch, Wilson, Kowalevsky and Marion, and Lacaze-Duthiers, the following notes may be of service.

Attached to the mesenteric bands there were elongated clusters of ova at different stages of ripeness. Some of these were seen to have a very definite envelope, from which a stalk ran to the mesentery. Other larger egg-like bodies were lying freely in the coelenteron. An examination of these showed that they were already well advanced in development, that they were, in fact, diploblastic *embryos*. Most were spherical or slightly ovoid, and some showed an invagination at one pole. A few were solid, most showed a well-developed coelenteron. The following measurements of the diameter or of the longer axis were taken:—0.4, 0.5, 0.6, 0.7, 0.8 mm. In many cases the wall was about 0.1 mm. in thickness, of which about four-fifths was due to the inner layer.

The ectoderm consisted of a single layer of columnar cells, sometimes with large vacuoles; the endoderm consisted of a dense mass of small cells, in the middle of which there was usually a large coelenteron. In most of the sections the endoderm appeared like a syncytium, and about half a dozen nuclei lay on every radial line across the wall one chose to follow. A very distinct double-contoured middle-lamella or mesogloal plate lay, like a double basal membrane, between the ectoderm and the endoderm.

It seems, therefore, that we have to do with planulae, very clearly differentiated into two layers, the inner of which is several cells thick. It is probable that the coelenteron is formed by histolysis in the middle of the endodermic mass. There was no trace of typical gastrulae. It is likely that the invagination or dimple seen in many cases at one pole is the

beginning of the stomodæum. Only in one section was there a hint of a blind stomodæal insinking insinuating itself into the cœlenteron, but the appearance was not sufficiently definite to be convincing.

Apart from the embryos, I have found little that is new to report, but I thought it might be both useful and interesting to gather together some of the references to this very beautiful northern Alcyonarian, and to submit these to a Society which has been for so long a repository for observations on the Scottish Fauna.

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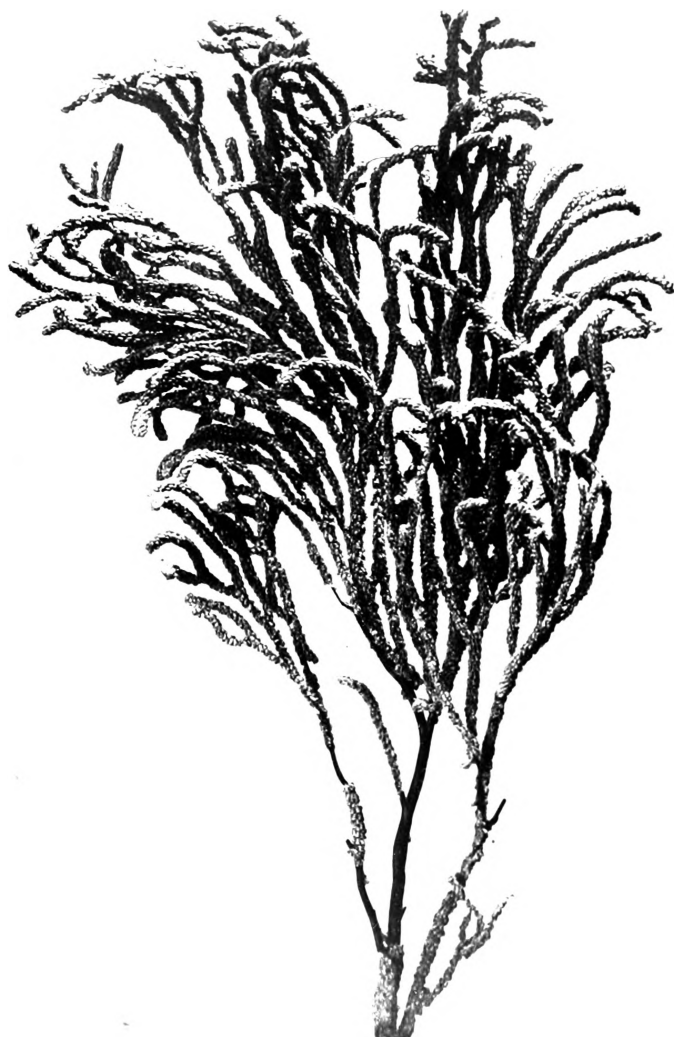
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REFERENCE TO PLATES.

Plate I. Photograph of the Colony.

Plate II. A Twig in Natural Size and Colour.

PLATE I.



PRIMNOA RESEDA

PLATE 2

PLATE

Long Throated Noddy, Laysan



PLATE 2

V. *On the Occurrence of a Supposed Australasian Hydroid*
(*Sertularia elongata*) *in the North Sea.* By JAMES
RITCHIE, M.A., B.Sc., University of Aberdeen. [Plate
III.]

(Read 28th January 1907.)

In November 1904, Mr J. J. Simpson, M.A., B.Sc., while searching for chance specimens in the nets of the trawlers lying at Aberdeen Fish Market, came upon a magnificent cluster of Hydroid colonies, which he kindly handed to me for identification.

The colonies, of which there were about forty-five in the bunch, are fixed upon a slender twig, 0·2 mm. in diameter and 11 cm. in length, which is in many places encrusted by Polyzoa. They vary considerably in size, the largest about 8 cm. in height and 1·5 cm. in breadth, the smallest about 2 cm. by 0·45 cm. When Mr Simpson found the specimens, the cœnosarc had already wholly disappeared. Both the hydrocaulus and the gonothecæ (which are numerous, some of the colonies bearing a gonotheca on almost every pinna) agree specifically with the descriptions and figures of *Sertularia elongata*, Lamx., given by Prof. D'Arcy W.

Thompson (1879), by Bale (1884), and by Allman (1885). Our specimens do not show more than three pairs of hydrothecæ on any one internode, while Bale records that four or even five pairs occasionally occur, nor are there present branches of other than the regular pinnate order. But in these respects our specimens agree with those of Prof. D'Arcy W. Thompson, C.B., to whom I am indebted for the opportunity of examining his fine collection.

As to the known distribution of *Sertularia elongata*, so far as we can learn, it has been recorded from the south coast of Australia, where Bale (1884) says it is one of the most common species, more particularly from Cape Wilson, Port Philip, etc., in Victoria (Dr F. Müller, cited by Thompson, 1879); from Tasmania (Allman, 1885), particularly from Georgetown and Bass's Straits (Dr Harvey, cited by Thompson, 1879); from West Australia (Allman, 1885); from New Zealand, where the species is less common than in Australia (Gray, 1843; Hutton, 1872; Coughtrey, 1874), particularly from Lyall Bay, Wellington (Farquhar, 1895), and Kuri and Taieri beaches, Otago (Hilgendorf, 1897). That is to say, the distribution is limited to Southern Australasia. The West Australian locality of Allman is of special interest because, while our specimens differ in detail from his Tasmanian examples, they agree absolutely with the West Australian form in all the points which he singles out as peculiar to it.

The trawler in whose net the present specimens were found had been trawling off the Shetland Isles, and, on the return journey to Aberdeen, off Buchan Ness, the last haul having been taken in the neighbourhood of the "Buchan Deep." Consequently, the presumption is that the specimen found in the trawl-net came, if not from the last haul in the "Buchan Deep," at least from some locality in the North Sea. It remains to account for the presence of a species, so distinct and with so limited a distribution, in the North Sea. Three possibilities suggest themselves—(1) that the species grows in the North Sea; (2) that the specimen was brought thither attached to the bottom of a ship, as *Tubularia crocea*, Agassiz, was, in 1895, brought from Peru to Plymouth Sound

(Browne, 1899); (3) that the specimen has drifted thither from its Australasian locality.

The twig to which the colonies are attached helps to a conclusion. Cross and longitudinal sections are characteristic, showing a central strand of sclerenchyma surrounded by loose lacunar tissue, which again is surrounded by a thick band of sclerenchyma. The twig and sections were shown to Prof. J. W. H. Trail, M.D., F.R.S., to whom I am indebted for kind assistance, and he pronounced the branching and microscopic structures to be those characteristic of the marine phanerogams of the subfamily Cymodoceæ in the family Potamogetonaceæ. This subfamily contains but nine species, all of them, with one exception, belonging to tropical or south temperate seas, the majority occurring in West Indian, Indo-Pacific, and *Australian* waters (Engler and Prantl, 1889). The exception, the only north temperate form (*Phucagrostis major*), occurs in the Mediterranean Sea and along the Spanish and African coasts, but its structures are quite distinct from those of the present specimen, and it may therefore be left out of consideration. If, then, it is assumed that the North Sea Hydroid specimen grew upon the plant *in situ*, and it is the habit of *Sertularia elongata* to grow upon seaweeds (*vide* Bale, Allman, etc.), the twig may be taken as indicating a tropical or south temperate origin for the specimen.

Since so conspicuous a Hydroid has not been recorded by any of many careful workers, and has not been found in many recent dredgings, from the North Sea, and since it has grown upon an exotic plant, the first supposition, that the species grows in the North Sea, may be rejected. The second supposition is also rendered impossible, because the very fact that the specimens have grown upon a twig excludes the possibility of their having been attached to a ship's bottom and thus transported. The conclusion remains, and it is indicated by the known distribution of *Sertularia elongata*, as well as by the characters of the twig to which the specimens are attached, that the North Sea specimen has drifted, probably from an Australasian, perhaps from a West Australian, locality to the spot where it was picked up.

The ocean currents are not inconsistent with that view. While a specimen from South Australia would tend to drift towards New Zealand, a specimen set free upon the west coast of Australia (and the minutiae of the present specimens agree with those of West Australian specimens) might be borne by an Indian Ocean south equatorial current round Cape Colony, whence, caught up by a north-travelling branch of the Antarctic drift, it might be carried into an Atlantic south equatorial current moving north-westwards into the Gulf of Mexico, and thence the Gulf Stream drift might bear it to the waters of the North Sea.

The journey is a long one—it has probably left its traces in the empty perisarc and the polyzoon-encrusted twig—and the chances against its successful completion are many, but it seems the only satisfactory way of accounting for the interesting occurrence of so distinct a Hydroid species off the Scottish coast.

The suggestion has been made that the specimen may have been taken accidentally, along with packing or ballast, on board some ship loading at an Australasian port, and was afterwards set free on the discharge of the ballast in the neighbourhood of Aberdeen. Such a mode of transport, however, involves so many coincidences of place that it seems highly improbable; and, besides, the condition of the specimen itself argues against the supposition, for it is difficult to believe that a number of large and fragile colonies could be first cast upon a rough sandy or shingly shore (suitable for ballast), and afterwards tossed about amongst ballast at loading and unloading, without suffering a considerable amount of damage. And yet in the present case, as the accompanying photographic reproduction (Plate III.) very clearly shows, almost all the colonies are complete, with naturally terminated stems and perfect pinnæ, upon practically every one of which, in the more mature colonies, are perched exceedingly delicate, loosely attached gonangia. The perfection of structures so fragile excludes the possibility of carriage by methods other than the most gentle, but is such as we might expect in a water-borne specimen, the sport of gently flowing oceanic currents.

After all, the mode of transport from Australasian waters to the North Sea matters little, and does not affect the main purposes of this notice, namely, to record its occurrence and to show that the species in question, although it has been found in, is not indigenous to, British waters.

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EXPLANATION OF PLATE.

Colonies of *Sertularia elongata* picked up in the North Sea (slightly reduced).

The central thicker and whiter rod is the twig over which the hydro-
rhiza of the colonies ramify, the whiteness being due to an encrusting
polyzoon layer.

PLATE III

Vol. XVII.

Royal Physical Society, Edinburgh



FROM THE NORTH SEA

COLONIES OF SERPULARIA FLAGELLATA FROM THE NORTH SEA

[*From the* PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON,
1907.]

[Published October 8, 1907.]

On Collections of the Cape Verde Islands Marine Fauna, made by Cyril Crossland, M.A. (Cantab.), B.Sc. (Lond.), F.Z.S., of St. Andrews University, July to September, 1904.*—The Hydroids. By JAMES RITCHIE, M.A., B.Sc., Fullerton Scholar, University of Aberdeen †.

(Plates XXIII.–XXVI.‡ and Text-figures 142–144.)

The forms described in the present paper were entrusted to me for determination by Mr. Crossland, who collected them in various localities off the Cape Verde Islands. Although the collection is not a large one, it forms a useful addition to our rather meagre knowledge of the Hydroid fauna of the northern portion of the west coast of Africa. To the north of the Cape Verde Islands specimens have been recorded from the Canary Islands, from Madeira, from the Azores, and from the Soudan coast; from the south the 'Challenger' records a solitary species, *Cryptolaria diffusa* Allm. from Sierra Leone; while from the islands themselves, so far as I can learn, records have been made by only four workers §. In 1883 Allman, in his Report on the Plumularians collected by the 'Challenger,' described the type of a new genus, *Streptocaulus pulcherrimus* Allm., found at Porto Praya in 100 fathoms. In July 1885 Mr. J. J. Quelch described a small collection of deep-sea Hydroids, comprising nine species, and obtained from the cable off St. Vincent in a depth of over 500 fathoms, the species described being *Eudendrium annulatum* Norman 1864, *Lafodia tenellula* Allman 1877, *Zygophylax profunda* Quelch 1885, *Plumularia variabilis* Quelch 1885, *P. delicatula* Quelch 1885, *Antennularia irregularis* Quelch 1885, *A. profunda* Quelch 1885, *Aglaophenia acacia* Allman 1883, and *Streptocaulus pulcherrimus* Allman 1883. More recently Professor J. Versluys has described two species from Isle Branco, one of the Windward Group, *Sertularia (Desmoscyphus) brevicylathus* (Vers. 1899), and *Desmoscyphus inflatus* Vers. 1899, a synonym for the *D. gracilis* of Allman 1888, which has been renamed *Sertularia versluysi* by Professor Nutting (1904). Of these the latter occurs in our collection, with the important addition that the gonosome is also present and is here described for the first time. Lastly, within the past month or two collections made by the 'Talisman' in 1883 have been described by Dr. Armand Billard (1907), and these include a few species from two localities off the Islands. In lat.

* The expenses of Mr. Crossland's collecting trip were borne by the Carnegie Trustees.

† Communicated by the SECRETARY.

‡ For explanation of the Plates, see p. 514.

§ Since this paper was written I have found in the collections made by the Scottish National Antarctic Expedition on its homeward voyage two species from St. Vincent which were not represented among the specimens described in the Report on the 'Scotia' Hydroid Collection (Ritchie, 1907). These are *Encopella crenata*? Hartlaub, 1901, and *Sertularella fusiformis*? Hincks, 1861, both of which are additions to the recorded Hydroid fauna of the Islands.

17° 1' N. and long. 27° 24' W. (Paris 0°) at a depth of 105 metres there were obtained *Diphasia pinaster* (Ellis & Sol. 1786), *Antennularia ramosa* Lamarek 1816, and *Thecocarpus myriophyllum* var. *bedoti* Billard 1907. In lat. 16° 52'–16° 53' N. and long. 27° 30'–27° 26' W. at a depth of 400–580 metres, *Diphasia pinaster* and *Thecocarpus myriophyllum bedoti* were again found.

The present collection is littoral, the greatest depth at which specimens were gathered being 15 fathoms, while the majority were obtained in shore-pools or in quite shallow water. Hence it is not surprising to find that of the species previously described from the Islands only one, *Sertularia versluysi* above mentioned, should recur among Mr. Crossland's specimens.

The collection contains in all 27 species, of which 18—one of them here represented by a new variety—have been previously described. Several of these species, which are distributed among 14 genera, have been recorded from more than one locality. For the remaining specimens 9 new species have been established, one species being referred to a new genus. In all representatives of 20 genera occur in the collection.

The list of species is as follows:—

I. GYMNOBLASTEAE.

Family CORYNIDÆ.

Coryne (?) *dubium*, sp. n.

Family PENNARIIDÆ.

Pennaria cavolinii Ehrenberg 1832.

Family TUBULARIIDÆ.

Tabularia humilis Allman 1864.

„ *solitaria* Warren 1906.

Family CLAVIDÆ.

Soleniopsis dendriformis, gen. et sp. n.

Family BOUGAINVILLIIDÆ.

Hydractinia verdi, sp. n.

Podocoryne anechinata, sp. n.

Family EUDENDRIIDÆ.

Eudendrium ramosum Linn. 1753.

II. CALYPTOBLASTEAE.

Family HALECIIDÆ.

Halecium beanti Johnston. 1838.

Ophiotes caciniformis, sp. n.

Family LAFŒIIDÆ.

Filicium serpens (Hassall 1852).

Cuspidella humilis Hincks MS. & 1866.

Family CAMPANULARIIDÆ.

Clytia geniculata Thornely 1904.

Obelia dichotoma (Linn. 1758).

Gonothyrea gracilis (Sars 1851).

Campanularia caliculata Hincks 1863.

„ *psychocephalus* Allman 1888.

„ *mutabilis*, sp. n.

Family SERTULARIIDE.

Sertularia distans Lamx. 1816." *mayeri* Nutting 1904." *versluysi* Nutting 1904." *levimarginata*, sp. n.

Family PLUMULARIIDE.

Plumularia halecioides Alder 1859.*Monostechas quadridens* (McCrary 1857).*Aglaophenia marginata*, sp. n.*Lytocarpus grandis*, var. *unilateralis*, var. n." *crosslandi*, sp. n.

Of the 18 hitherto known forms above mentioned, 10 are recognised as British species, while 5 of the remainder (*Campanularia ptychocyathus*, *Sertularia mayeri*, *S. versluysi*, *Lytocarpus grandis*, *Monostechas quadridens*) are, with the exception of the last which has been recorded from the Indian Ocean (Thornely, 1904), distinctively American. This contingent is probably to be accounted for by the oceanic whirlpool the centre of which is marked by the Sargasso Sea and the streams of which wash the shores of the West Indies, of eastern Mexico, and of the eastern United States, and, circling in the North Atlantic, sweep past the Azores, Madeira, and the Cape Verde Islands.

The collection, as might be expected in a littoral one, is comparatively rich in gymnoblastic forms and includes an interesting species, peculiar in branching and in gonophore, which has been made the type of a new genus, *Soleniopsis*.

We note also, as Pictet has already remarked (Pictet, 1893), that of those species which occur both in temperate and in tropical waters, the individuals existing in the colder seas are, in general, larger and more sturdy than their tropical specific equivalents.

The outlines of the figures, both in the plates and in the text, with the exception of those representing the appearance of the specimens to the unaided eye, were drawn with the help of Zeiss's camera lucida.

The localities from which Mr. Crossland obtained his specimens are shown below:—

ST. VINCENT, CAPE VERDE ISLANDS.

(1) GENERAL.

(a) From tidal pool, 25th July, 1904.

Pennaria cavolinii Ehr.

(b) 2 fathoms, among coral, 22nd July, 1904.

Pennaria cavolinii Ehr.*Sertularia mayeri* Nutt.*Plumularia halecioides* Hincks.

(c) 10 fathoms, 27th July, 1904.

Gonothyræa gracilis Sars.*Campanularia ptychocyathus* Allm.

(d) 15 fathoms, 30th July, 1904.

Monostechas quadridens (McCrary).*Lytocarpus grandis*, var. *unilateralis*, var. n.

- (e) From bottom of a lighter, 20th July, 1904.
Tubularia humilis Allm.
Cuspidella humilis Hincks.
Plumularia halecioides Alder.
Aglaophenia marginata, sp. n.
- (f) From bottom of a lighter, 30th July, 1904.
Pennaria cavolinii Ehr.
Tubularia humilis Allm.
" *solitaria* Warren.
Soleniopsis dendriformis, gen. et sp. n.
Halecium beanii Johnst.
Filellum serpens (Hassall).
Cuspidella humilis Hincks.
Clytia geniculata Thorn.
Obelia dichotoma Linn.
Campanularia ptychocyathus Allm.
" *mutabilis*, sp. n.
- (2) MATTIOTA, ST. VINCENT HARBOUR.
Sertularia laevimarginata, sp. n.
Lytocarpus crosslandi, sp. n.
- (3) PORTO GRANDE.
(a) Shore-pools.
Campanularia caliculata Hincks.
" *ptychocyathus* Allm.
Sertularia distans Lamx. 1816.
" *mayeri* Nutt.
- (b) 10 fathoms.
Hydractinia verti, sp. n.
- PORTO PRAYA, SANTIAGO, CAPE VERDE ISLANDS.
(a) Piles of pier, 12th August, 1904.
Coryne (?) *dubium*, sp. n.
Campanularia mutabilis, sp. n.
Sertularia versluysi Nutt.
- (b) 5 fathoms, 9th August, 1904.
Podocoryne anechinata, sp. n.
- (c) 10 fathoms, 12th August, 1904.
Eudendrium ramosum Linn.
Ophiodes cuciniiformis, sp. n.
- BOA VISTA, CAPE VERDE ISLANDS.
Soleniopsis dendriformis, gen. et sp. n.

I. GYMNOBLASTEAE.

Family CORYNIDÆ.

CORYNE (?) *DUBIUM*, sp. n. (Plate XXIII. figs. 1, 2.)

A species represented by small, irregularly ramified colonies growing upon a *Polysiphonia*-like red seaweed. The colonies are only about 7 mm. in height. The perisarc is transparent, tinged.

except towards the tips of the branches, with a faint brown. The stem is slender, 0.1 mm. in diameter, and soon breaks up into very numerous, irregularly disposed branches which, arising at a small angle, lie for a short distance almost parallel with their parent shoot and thereafter gradually diverge from it. Branches even of the fourth order are present. The colonies are wrinkled throughout, but less strongly in the middle portions of the polyp-bearing branches; while beneath the polyp, on the stems, and on the older portions of the branches distinct ringing occurs. There is no membranaceous cup surrounding the base of the hydranth. The hydranths are relatively long, 0.5 mm., slightly bulging beneath and tapering gradually upwards towards the tip and downwards to form a long "neck." The tentacles are from 0.1 to 0.15 mm. in length, and except for the distal four, which generally appear to be placed in a whorl, are scattered. They vary slightly in number. Thus of 10 heads examined, one bore 12 tentacles, four bore 13, three bore 14, and on two 15 were found.

Gonosome not present.

Locality. Growing on a seaweed taken from piles of pier. Porto Praya, Santiago, Cape Verde Islands; 12th August, 1904.

Owing to the absence of the gonosome this species cannot be given a definite generic place within the family Corynidae as defined by Delage (1901). Notwithstanding I have assigned a specific name to the form in order to facilitate references. The trophosome characters lie between those of *Actinogonium pusillum* (Van Beneden 1844; Hincks, 1868, p. 45; Allman, 1872, p. 272) and *Syncoryne sarsii* Lovén 1835. From the former it differs in having a more tapering polyp, numerous rings and wrinkles, and in lacking a membranaceous cup beneath the polyp; from the latter it is distinguished by the shape of its hydranth, its much smaller size, its complicated branching, its more frequent rings.

The specimens bear many creeping polyzoon colonies (*Clionella*?) and occasional stalked protozoa and diatoms.

Family PENNARIIDÆ.

PENNARIA CAVOLINII Ehrenberg 1832.

A number of colonies, frequently over 6 cm. in height, have been obtained from one locality. They agree in general with Allman's description (1872, p. 364), but the following variations may be noted:—The colonies are less robust than those described by Allman. The branches, while alternate, lie generally in two planes, every other branch being in the same plane, and these planes are set forward on the stem, as in many Plumularian species, so as to meet at an angle varying from almost 180° to less than 20°. Ringing is well marked, from four to six rings occurring on the stem above the origin of each branch, and a similar number at the base of the branch itself. Thus the ultimate hydranth-bearing ramuli, instead of being wholly ringed as described and figured by Allman, bear a small number of basal

rings; the remainder, which varies much in length, being smooth or very slightly crumpled.

The gonosomes, which are present in numbers, agree exactly with Allman's description.

The colonies here described agree in all but size with beautifully preserved specimens of the species from the Naples Biological Station.

Locality. St. Vincent, Cape Verde Islands. Obtained from bottom of a lighter, 30th July, 1904; by diving among coral in 2 fathoms of water, 22nd July, 1904; also fine colony in tidal pool, 25th July, 1904.

Family TUBULARIIDÆ.

TUBULARIA HUMILIS Allman 1864.

A few simple or slightly branched stems varying from 0.5 to 4 cm. in height, and 0.5 mm. in diameter, may be referred to this species. The specimens obtained in one dredging are much smaller than those described by Allman, varying from 5 to 12 mm. in height; but the following points have been relied on in identification:—simple or slightly branched stems with, here and there, faintly marked transverse rugosities; delicate, light-yellow perisarc; a cenosarc collar supporting the hydranth; small hydranths, 1.2 mm. in height, longer than broad, with, in the individuals examined, 17, 13, 11 tentacles in the distal whorl, and 19, 17 in the proximal. The tentacles are in a state of contraction, and consequently the proximal whorl is only 1.8 mm. in diameter from tip to tip.

Gonosome.—In the specimens obtained on the 30th of July gonophores are present in erect clusters borne on short pedicels. In some of the more mature, actinulae can be seen.

Locality. St. Vincent, Cape Verde Islands. Found growing on the bottom of a lighter on 20th and 30th July, 1904, and by diving among coral in 2 fathoms of water on 22nd July, 1904.

TUBULARIA SOLITARIA Warren 1906.

A few solitary individuals, 8 mm. in height, are growing upon a sponge-like layer encrusting a small lamellibranch shell. The individuals are fixed in the layer by a club-like, sometimes branched "root," and are crowned by a distal circle of stout tentacles 13 or 14 in number, the lower portions of which are adnate to the hypostome, appearing as strong ridges upon it. The proximal tentacles, which are more slender than the distal, arise from the broadened base of the hydranth in a whorl of about 30, rather more than in Dr. Warren's specimens. Otherwise, the present specimens, with delicate perisarc, distinct endodermal canals in the hydrocaulus, erect blastostyles originating just within the proximal whorl of tentacles and bearing from two to five or six gonophores, agree with the description of the type.

The gonophores in our specimens are mostly at an early stage,

showing in optical section a manubrium surrounded by a horse-shoe-shaped mass of generative plasma. In only one gonophore of the many examined was there a trace of actinula-formation, tentacles being indicated by apparently about 8 filaments.

Locality St. Vincent, Cape Verde Islands. Found on bottom of a lighter, 30th July, 1904.

Previous record, off Natal coast.

Family CLAVIDÆ.

SOLENIOPSIS*, gen. nov.

Type. *S. dendriformis*, sp. n.

GENERIC CHARACTERS.—*Trophosome*. Colonies branched and fascicled. The branches originate from the division of a cenosarc strand into two portions which lie parallel and close to one another for a considerable distance, each becoming sheathed in a chitinous perisarc tube, the outermost strand finally bends outwards and becomes free to form a branch (*vide* text-fig. 142, p. 496). The hydranth-bearing ramuli originate in the same way as the branches. Hydranths cylindrical, with club-shaped proboscis and many scattered filiform tentacles.

Gonosome.—The reproductive bodies are permanently fixed gonophores of a simple type. They are blind sacs arising from the cenosarc some distance beneath the hydranth and lying within the perisarc tube from which the hydranth projects. The ova are developed in the wall of the sac.

The genus *Soleniopsis* is distinguished by its peculiar mode of branching and by its gonophore. The branching, which is more fully described in the discussion on the species, appears to be similar to that of *Corydendrium* (Weismann, 1883). I have not seen the original description, but Dr. Fowler says with regard to the branching of the genus, "The young buds, instead of breaking through the perisarc and growing outwards as is usual, grow upwards for some distance inside it and surround themselves with secondary perisarc" (Fowler, 1900, p. 13); and this agrees with the structure in the present genus. *Corydendrium* differs from *Soleniopsis*, however, in having gonophores which give rise to free medusæ (Delage, 1901).

The gonophores here are of great length and of extremely simple structure. They are also peculiar in lying within, and thus being protected by, the tube which contains the trophosome, instead of bursting through the perisarc and forming hernia-like globular projections like most other gonophores. The ova and spermatozoa apparently escape from the mouth of the tube, passing between the swollen bulb beneath the neck of the hydranth and the perisarc wall.

On account of the scattered filiform tentacles on the hydranth

* The name of the genus, *Soleniopsis*, is intended to suggest the resemblance between the parallel-lying cenosarc strands of the colony and the "solenia" of Alcyonarians.

and of the fixed gonophore, this genus has been included in the family Clavidae, although the simplicity of the gonophore and the complexity of the branching almost warrant the formation of a new family.

SOLENIOPSIS DENDRIFORMIS, sp. n. (Plate XXVI. fig. 1; text-figs. 142, 143.)

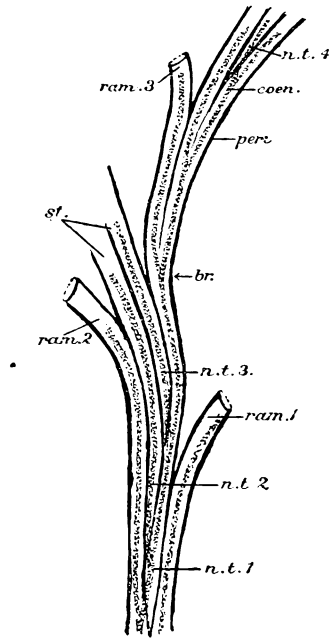
The colonies for which this species has been formed were found at two localities. The solitary colony from Boa Vista is the largest of the series, almost 10 cm. high, with a thick, fascicled stem which is, towards the base, covered by a mass of ramifying tubes, forming a spongy tissue through which here and there a hydranth projects. This loosely-built basal mass attains a diameter of 1 cm. From this stem, which in transverse section shows a small central strand of chitin with a few minute cenosarc-containing canals, surrounded by many parallel tubes which again are surrounded by irregularly arranged, loosely aggregated tubes, the branches arise approximately in one plane. The colonies from St. Vincent are smaller, only 6 cm. high, and lack the spongy basal thickening, possessing a cylindrical stem 2 mm. in diameter, composed of closely packed parallel tubes. From these stems, as from that of the previous specimen, flabellate branches lying generally in one plane arise. The primary branches bear alternate secondary branches, and these again may bear tertiary branches, all of these appearing to be fascicled owing to the apposition of several tubes. Single, monosiphonic branches, however, arise alternately in one plane, for the most part from branches of the second and third order, and from the distal end of these the hydranths project.

The mode of branching is peculiar. In the less strongly fascicled portions of the stem two or three perisarcal tubes lie alongside of, and inseparably united to, one another, each containing a strand of cenosarc. Some considerable distance before a free branch originates (frequently 20 or 30 mm.) one of the outermost strands divides into two, and round the new cenosarc-division a chitinous tube is formed, wedged in between the old tubes. Thus the number of parallel lying and united tubes is increased, but finally, after a course of some 2 or 3 cm., the outermost of the two portions into which the original strand divided becomes free to form a branch, and the number of tubes in the fascicle is thus reduced. The cenosarc of the free branch divides, as did that of the stem, and becomes ensheathed in several united tubes which, on bending outwards and becoming free, form new branches or hydranth-bearing ramuli. The division of the cenosarc strands, and consequently the origin of the branches and ramuli, takes place alternately, first on one side, then on the other.

The hydranths project from simple, alternate ramuli 0.4 mm. in diameter. Extended they are long and slender, 2.0 mm. by 0.2 or 0.3 mm., almost cylindrical, with a prominent club-shaped

proboscis and short (0.3 mm.) stumpy tentacles. These, between 40 and 50 in number, are scattered over the body of the polyp, only the distal 4 or 5 being placed in a whorl, although an approximation to whorling is sometimes simulated by others of the tentacles. At the proximal end of the hydranth there is a short neck, and just within the margin of the tube a sharp bulge connecting the polyp with the cœnosarc of the ramulus and almost

Text-fig. 142.



Soleniopsis dendriformis. To show mode of branching, $\times 8$.

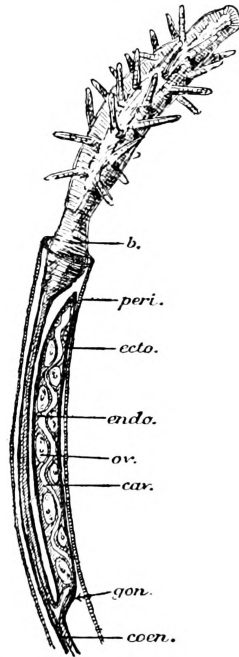
cœn., cœnosarc; *peri.*, perisarc; *br.*, branch bending off and becoming free from main stem; *st.*, main stem; *ram.* 1, 2, 3, short ramuli from which hydranths project; *n.t.* 1, 2, 3, 4, new tubes, enveloping a branch from a cœnosarc strand and wedged in between older tubes.

plugging up the entrance to the tube. Contracted, the hydranths form almost spherical bulbs about 0.7 mm. in diameter. Although the tube from which the hydranth springs generally ends abruptly with an even circular margin, in not a few cases the terminal

portion is wrinkled and twisted as if it were less strong, more collapsable than the other portions.

Gonosome.—The gonophores are fixed, not developing into free medusoids, and lie within the tube from which the hydranth projects. They branch off from the cœnosarc of the ramulus from 2 to 3 mm. below the hydranth itself, and are long, slender, spindle-shaped bodies, sometimes 2.5 mm. in length by 0.1 mm

Text-fig. 143.



Soleniopsis dendriformis. Hydranth and gonophore, $\times 30$.

b., bulging portion at base of hydranth almost filling the opening of the tube; *peri.*, perisarc; *ecto.*, ectoderm, represented within the tube by a dark line; *endo.*, endoderm (lined); *ov.*, ovum; *cav.*, central cavity of gonophore; *gon.*, the arrow points to the place where the gonophore branches off the general cœnosarc; *cœn.*, general cœnosarc.

in diameter. Their structure is simple, the gonophore being apparently a hollow cylinder closed distally, with two-layered walls, a thick ectoderm and thinner endoderm, within which ova develop to the number of about 13 or more. The ova develop

all along the walls, pushing the endoderm inwards until it protrudes into the hollow of the gonophore. The male gonophores are similar in origin and shape to the female, but are in general considerably longer. In no case could a spadix be distinguished.

The structure of the gonophore above described is of the simplest type. It appears to be merely a blind branch of the general coenosarc of the colony within the walls of which ova develop.

Associated with the specimens were several creeping Hydroids, *Filellum serpens*, *Cuspidella humilis*, *Campanularia mutabilis*, and an endoproctan polyzoon (*Clionella*?).

Localities. (a) St. Vincent, Cape Verde Islands: growing on the bottom of a lighter, 20th and 30th July, 1904.— (b) Dredged; Bea Vista, Cape Verde Islands, August? 1904.

FAMILY BOUGAINVILLIIDÆ.

HYDRACTINIA VERDI, sp. n. (Plate XXIII. figs. 6 & 7.)

Among dredgings taken at Porto Grande four *Fusus*-like gastropod shells were obtained overspread by *Hydractinia* colonies. The nutritive hydranths, which grow in the grooves of the shell-sculpture, are in various stages of contraction, the longest 5 mm., the shortest with their ring of tentacles almost resting on the surface of the shell. The tentacles are short, set in two almost indistinguishable whorls, and vary in number from 9 to 12, 9 being perhaps most frequent. The hypostome is club-shaped. No spiral filaments are present, although along the margin of the shell there occur elongated polyps with insignificant tentacles. Short chitinous spines, about 0.3 mm. long, with jagged edges, occur throughout the colony, being arranged for the most part upon the ridges of the shell. The blastostyles are somewhat smaller than the nutritive hydranths, being about 1 mm. in height, but unlike those of *H. echinata* they bear well-developed tentacles eight or nine in number. The basal rhizom expansion is thin.

Gonosome.—The reproductive bodies are fixed gonophores arising from the body of the blastostyle some distance below the tentacles. They occur in a single whorl containing three or four individuals and are borne on short peduncles. In the specimens examined the gonophores were all female, containing three large ova; while in the more mature examples these were separated towards the exterior by pigmented bands running from the base towards the summit of the gonophore—branches of the spadix.

This species is closely related to *H. pacifica* described from Calbuco by Hartlaub (1905, p. 519), but that species differs in possessing about 15 tentacles on the nutritive hydranths, only 5 or 6 on the blastostyles; in lacking spines on the basal expansion; in bearing only one ovum in each gonophore.

Locality. Porto Grande, St. Vincent, Cape Verde Islands; 10 fathoms.

PODOCORYNE ANECHINATA, sp. n. (Plate XXIII. figs. 8, 9, 10.)

Sparsely scattered up on a small gasteropod shell (*Cerithium?* sp.) are the minute individuals of a Podocoryne colony. The nutritive individuals are club-shaped, only 0.9 mm. in height, with a prominent, cylindrical, flat-topped hypostome, from beneath which arise about nine tentacles, set in two closely approximated whorls. Both spiral filaments and spines are absent. The reproductive polyps, although they are somewhat smaller than the nutritive with about seven well-developed tentacles, resemble the latter in shape, being also club-like and possessing a prominent cylindrical hypostome. The basal expansion is formed of a single layer of chitinous tubes, forming wide rectangular meshes, the individual tubes being almost 0.1 mm. in diameter, and being marked laterally by minute honey-yellow dots, thickenings of the chitinous wall. The whole expansion is covered by a thin layer of ctenosarc.

Gonosome.—The sexual stage consists of free-swimming medusoids which arise in considerable numbers (as many as nine being present on one individual) from the median portion of the reproductive polyp. They are borne on well-defined peduncles. During the earlier stages the tentacles appear as four blunt knobs, but these develop considerably ere the medusoid is set free. Sexual products could not be distinguished in the medusoid buds.

The species here described is a near relative of *P. humilis* Hartlaub 1905. The latter form, however, differs in possessing a minute conical hypostome, small smooth spines, and a medusoid bud which is not mentioned as developing well-formed tentacles ere it is set free. The difference in the number of tentacles is of little importance, although it is to be noted that here they form two closely-set whorls, but the chitinous thickenings which occur along the sides of the rhizom strands (*vide* Pl. XXIII. fig. 10) may help to distinguish the present species.

Locality. Porto Praya, Santiago, Cape Verde Islands, 5 fathoms; 9th August, 1904.

Family EUDENDRIIDÆ.

EUDENDRIUM RAMOSUM Linnaeus 1758.

A single, small, unfascicled colony about 4 cm. high. The branches and branchlets are strictly alternate, and the minute structure, except that the rings at the bases of the main branches are generally fewer in number, agrees closely with Hincks's figures (1868, pl. 13). The hydranths are well preserved and there were, in the examples counted, 23 or 24 tentacles surrounding a very distinct trumpet-shaped hypostome.

Gonophores not present.

Locality. Porto Praya, Santiago, 10 fathoms; 12th August, 1904.

II. CALYPTOBLASTEA.

Family HALECIDIÆ.

HALECIUM BEANII Johnston 1838.

Several strongly fascicled, irregularly branched colonies. The delicate structure of the terminal branchlets is characteristic of the species. The branches differ from those in the specimen figured by Allman (1888, pl. xii. fig. 3 *a*) in arising laterally from below a hydrotheca, instead of directly from the branch. The majority of the primary hydrothecæ differ from Allman's and from Hincks's (1868) figures in being sessile and adnate to the node from which they arise—the hydrotheca-tier springing from within the primary hydrotheca; but in these respects they agree with specimens from the French coast described by Dr. A. Billard (1904, p. 163), and with specimens from dredgings made by the Scottish Antarctic Expedition at Burdwood Bank, near Cape Horn (Ritchie, 1907).

The bright refringent points which encircle the base of the hydrotheca are in this species, as in others I have examined (1907, p. 515), points of attachment for strands from a fleshy disc at the base of the polyp, which is thus supported within its minute hydrotheca.

The gonosome is absent in the present specimens.

Locality. St. Vincent, Cape Verde Islands, growing on the bottom of a lighter; 30th July, 1904.

OPHIODES CACINIFORMIS, sp. n. (Plate XXIII. figs. 11 & 12 Plate XXIV. fig. 1; Plate XXV. fig. 5.)

Several small, delicate colonies, for which this species has been formed, arise at irregular intervals from a hydrorhizal stolon creeping upon a fragment of a sand-covered worm-tube. They are neither branched nor fascicled, and the largest is but 6·5 mm. in height. The stem is divided into short internodes, 0·4 mm. long in the proximal, but gradually lengthening to 0·6 mm. in the upper part of the colony. The distal end of each internode appears to divide into two equal, slightly diverging portions, one of which forms the peduncle of a hydrotheca, while the other bears the succeeding internode, the junction between the two internodes being marked by a single annulation.

The hydrothecæ lie in one plane, are placed one on each internode, and are alternate. They are borne on peduncles of varying length, from 0·05 to 0·2 mm., the upper portions of which are delicate and frequently crumpled, while the bases are thick-walled and, even when the hydrotheca itself has been destroyed, remain as projecting processes. The hydrothecæ themselves are shallow, trumpet-shaped cups, with much-everted margins, delicate walls, and a thin septum separating their cavity from that of the stem. Around the wall just within the margin is a row of refringent points formed by slight thickenings of the perisarc within the

hydrotheca, and to these are attached strands supporting a flattened disc-like portion at the base of the polyp. Such an attachment, of course, makes the retraction of the polyp impossible. The structure is identical with that which I have already described and figured in the genus *Halecium* (Ritchie, 1907, p. 525), except that in *Halecium* the basal disc rests upon the perisarcial septum at the bottom of the cup, while here a considerable space intervenes between the two, traversed by a narrow strand of cnosarc connecting the polyp with the common cnosarc of the colony. I would draw attention to the seeming inaccuracy of Hincks's figures (1868, pl. 45, figs. 2, 2') as regards the relations between polyp and hydrotheca. The hydranths, which are about 0.9 mm. in height, gradually increase in diameter upwards from the basal disc, but exhibit no distal contraction beneath the tentacles such as Hincks figures. The bases of the tentacles, which number about 23, are connected by a web within which the hypostome arises. A secondary hydrotheca, borne on a relatively long peduncle, may arise from the lower portion of the peduncle of a primary hydrotheca.

Nematophores occur frequently but irregularly. There is usually one on a peduncle, and sometimes one on an internode. They are sessile, cup-shaped, with delicate walls and everted margin, within which there is commonly a row of refringent dots. To these, as in the hydrothecæ, a basal cnosarcial disc is attached. The sarcostyles correspond to those figured by Hincks (1868, pl. 45), with thin walls bearing scattered cnidoblasts, and a globular head where large numbers of these offensive and defensive cells are aggregated. When contracted, a sarcostyle measures about 0.4 mm., while one which was extended measured 2.0 mm. The cnidoblasts are narrowly oval, $17\ \mu$ by $3\ \mu$, and each contains a thread $220\ \mu$ long, armed near the base with a whorl of four barbs in the form of a cross, distal to which are smaller barbs pointing towards the tip of the thread and placed in four longitudinal rows, each of which contains about nine gradually decreasing barbs (Plate XXV. fig. 5). The cnidoblasts occur throughout almost the whole colony, but are particularly common on the basal discs of sarcostyle and polyp, and at the tips of the sarcostyles and of the tentacles.

Occasionally solitary hydrothecæ and nematophores arise from the hydrorhizal tube.

The gonosome is not present.

Locality. Porto Praya, Santiago, 10 fathoms; 12th August, 1904.

Family LAFŒIDÆ.

FILELLUM SERPENS (Hassall 1852).

This species is represented by scanty specimens creeping on a fragment of a *Gymnoblast* colony. In essential characters the specimens agree with Hincks's description (1868), but they appear to be of less robust growth, while the margins of the hydrothecæ

are frequently marked by several "regeneration-lines," as in specimens from the North Sea in my possession.

The coppinia-gonosome is not present.

Locality. Creeping on *Soleniopsis dendriformis*, which was found growing on the bottom of a lighter: St. Vincent, Cape Verde Islands; 30th July, 1904.

CUSPIDELLA HUMILIS Hincks MS. & 1866.

Minute hydrothecæ arising here and there from a tubular stolon creeping upon *Soleniopsis dendriformis*. The hydrothecæ are delicate and cylindrical, generally 0.2 mm. in height by about 0.05 in diameter, although a rare specimen attained a height of 0.4 mm. They show in many cases a tendency to contract slightly towards the proximal end, while the distal end is crowned by convergent opercular segments. They agree with Hincks's description and figures of the species.

Gonosome not known.

Locality. (a) Creeping upon a polyzoon, which was obtained growing on the bottom of a lighter: St. Vincent, Cape Verde Islands; 20th July, 1904.—(b) Upon *Soleniopsis dendriformis*; 30th July, 1904.

Family CAMPANULARIIDÆ.

CLYTIA GENICULATA Thornely 1904.

Several small colonies, the largest rather under 1 cm. in height, growing on a polyzoon. The specimens agree in every respect with the original description and figures, the peculiar method of branching being particularly noticeable. The hydrothecæ, which are some 1.1 mm. long by 0.6 mm. in greatest diameter, bear from 18 to 20 long teeth; each tooth being strengthened by a median fold which is continued for a short distance down the wall of the hydrotheca as a more or less definite line.

The gonangia vary somewhat as regards their opening, sometimes having a plain, cylindrical, distal end; at other times with a distinctly constricted neck below the aperture. Sometimes they arise in pairs from the base of a pedicel.

Locality. Growing on polyzoa found on the bottom of a lighter; a single specimen on the back of a small crab. St. Vincent, Cape Verde Islands; 30th July, 1904.

OBELIA DICHOTOMA (Linnaeus 1758).

A few delicate colonies, the largest only 4 mm. high, occur on the carapace of a minute crab. The stems, which are unfascicled, are divided by slanting nodes into regular internodes 0.4 mm. in length, from the distal end of each of which arises a hydrotheca. Branches are frequent, sometimes 1.5 mm. in length, arising in every case from the side of a pedicel. They are thus alternate, and, like the stem, they bear alternate hydrothecæ, from the pedicels of which smaller branchlets with one hydrotheca may

arise. Frequently the branches end in blind stolons. The hydrothecae are alternate and are borne at the distal ends of the internodes on short pedicels marked by four or five annulations, the base of the internode above that from which the pedicel springs bearing a like number of rings. The calyces are short and subtriangular, with a rather wide aperture and an almost even, delicate rim. The whole colony is of delicate texture, the perisarc being remarkably clear and hyaline.

Gonosome not present.

The form described above seems to be a young stage of *O. dichotoma* Linn. Its much smaller size, its lack of horn-colour, its branches arising from *the side* of a pedicel, and the shorter subtriangular shape of its hydrothecae, are differences insufficient to distinguish it specifically from the older form.

Locality. On the carapace of a small crab found crawling on the bottom of a lighter: St. Vincent, Cape Verde Islands; 30th July, 1904.

GONOTHYRÆA GRACILIS (Sars 1851).

A few small specimens of this beautiful species occur growing upon a fragment of calcareous material. The colonies are only 8 mm. in height, and differ from those described and figured by Hincks (1868) in that the hydrothecae are somewhat less slender. The remaining characters—the peculiar origin of the branches, stuck on, one would almost think, as an afterthought, the gradual tapering of the hydrotheca towards its base, the number of the long pointed teeth, the ringings beneath the hydrotheca and at the proximal end of the branches—agree with previous descriptions.

Two long slender gonangia, with traces of a marginal collar as in Hincks's figures, are present, one arising from the hydrorhiza, the other from a peduncle.

Locality. St. Vincent, Cape Verde Islands, 10 fathoms; 27th July, 1904.

CAMPANULARIA CALICULATA Hincks 1863.

Typical examples of this species, with crenated pedicel, distal spherical segment, and thick-walled, smooth rimmed hydrothecae, occur creeping on a seaweed. In our specimens the pedicels average 0.5 mm. in length and are marked by about 10 crenations.

The gonangia are absent.

Locality. Porto Grande: creeping on seaweed in a shore-pool.

CAMPANULARIA PTYCHOCYATHUS Allman 1888.

Numerous crowded, pedunculate hydrothecae, and gonangia springing from a creeping stolon have been found on a polyzoon. The specimens agree closely with Allman's description and figures, especially characteristic being the delicate, frequently collapsed, distal portion of the hydrotheca, which in our specimens bears 10 long teeth; the stem with a few rings (generally two) beneath the hydrotheca and with several at the base; the smooth

cylindrical gonangia with marked constriction beneath the shallow saucer-like top.

From locality *c* there are only a few hydrothecæ growing upon *Sertularia distans*, gonangia being absent.

Localities. (*a*) Creeping on a polyzoon found on the bottom of a lighter: St. Vincent, Cape Verde Islands; 30th July, 1904. —(*b*) On a pebble, 10 fathoms: St. Vincent; 27th July, 1904. —(*c*) Creeping on *Sertularia distans*: Porto Grande, shore-pools; ? July, 1904.

CAMPANULARIA MUTABILIS, sp. n. (Plate XXIII. figs. 3, 4, 5.)

Rare specimens occur creeping upon *Sertularia versluysi* and *Soleniopsis dendriiformis*. From a thick-walled, creeping, hydro-rhizal tube the hydrothecæ arise at irregular intervals. They are borne on thick-walled peduncles with a length roughly three-fourths that of the hydrotheca, varying from 0.4 to 0.8 mm., and marked by from four to eight well-defined twists. The hydrothecæ are large but vary from 0.8 to 1.2 mm. in length and from about 0.5 to 0.6 mm. in breadth. They are almost campanulate in shape, gradually widening upwards to the margin, which is frequently oblique, is beautifully recurved, and is sometimes reduplicated (Pl. XXIII. fig. 3). A slight ridge of perisarc at the base of the hydrotheca forms a platform upon which a cœnosarcial disc at the bottom of the hydranth rests, and beneath this, seemingly within the peduncle, is a delicate basal septum. The hydrothecæ are seldom set symmetrically upon their peduncles. Owing to the state of preservation, the structure of the hydranth could not be recognised. The tentacles appeared to be few in number.

Gonosome not known.

Localities. (*a*) St. Vincent, Cape Verde Islands: growing on specimens obtained from the bottom of a lighter; 30th July, 1904. —(*b*) Piles of pier: Porto Praya; 12th August, 1904.

The specimens from Porto Praya (only a few hydrothecæ have been found) are considerably larger than those from St. Vincent, but the specific structures in the two sets of specimens are identical (*cf.* fig. 5 and figs. 3 & 4, Pl. XXIII.).

This species approaches *Lafoëa pocillum* Hincks 1868, from which however it differs greatly in shape and in possessing an everted margin. From *Campanularia corrugata* Thornely 1904, it may be distinguished by its strongly-twisted peduncle, its campanulate shape, and its non-corrugated walls.

FAMILY SERTULARIIDÆ.

SERTULARIA DISTANS* Lamouroux 1816.

A species represented by a few colonies growing upon a seaweed. The largest specimens are 7 mm. high, while the internodes

* In accordance with the recent determination of Dr. A. Billard (1907), who has had an opportunity of examining the type specimen of Lamouroux, I have substituted the designation of that author for the more usual synonym *S. gracilis* Hassall.

average 0.4 mm. in length. The hydrothecæ are free for rather more than half their height distally, the free portion being sharply divergent. The margin is divided into two lateral teeth, and there are two opercular flaps. The specimens agree closely with the descriptions and figures of Hincks (1868) and Nutting (1904).

Gonangia not present.

Locality. Porto Grande: shore-pools; ? July 1904.

SERTULARIA MAYERI Nutting 1904.

Several specimens of this species have been obtained. The specimens agree in all respects with the description given by Nutting, except that in our forms, which are smaller than the American specimens—the maximum being about 7 mm.—the hydrothecæ appear to be rather more closely approximated, the length of an internode being only 0.6 mm. While in many cases the margin and operculum had collapsed, as described by Nutting, in others this portion of the hydrotheca retained its form, and two large lateral teeth, with sometimes a minute median superior tooth, and a two-flapped operculum could be distinguished.

Gonosome not known.

Localities. (a) Porto Grande, St. Vincent, Cape Verde Islands: creeping on seaweed found in shore-pools.—(b) On seaweed found by diving among coral in 2 fathoms of water: St. Vincent, 22nd July, 1904.

SERTULARIA VERSLUYSI Nutting 1904. (= *Desmoseyphus gracilis* Allman 1888.) (Plate XXIV. figs. 2, 3, 4, 5, 6, & text-fig. 144.)

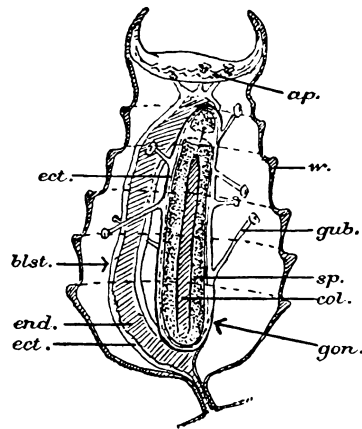
A large number of colonies varying from 2 to 4 cm. in height. The stem is erect, unfascicled, and springs from a spreading mass of hydrorhiza. The lower portion of the stem for a distance varying from 3 to 10 mm. is smooth, thick-walled, and unbranched and usually bears two straight internodes. The remainder, which is separated from the unbranched portion by a long, sloping, splice-like joint, is divided by slanting nodes into regular internodes about 0.7 mm. in length, each bearing three hydrothecæ—two on one side, one on the other. From beneath the lower of the two hydrothecæ the branches arise. They are about 4 mm long, are regularly alternate, thus giving the colony a plumose appearance, and are divided into internodes, 0.4 mm. long, by nodes which slope from behind forward and downward. They are placed slightly on the front of the stem, and are borne on a long stem-process, but arise at an angle of 60° rather than at right angles as described by Nutting.

The hydrothecæ are placed on the front of stem and branches on the former they are alternate and apart, while on the latter they are opposite, and contingent for the greater part of their length, the distal free portion being bent at right angles to the adnate portion. The hydrotheca pairs are distant from one another about the height of a hydrotheca. The hydrothecæ, short

and stout proximally, gradually narrow towards the opening, which is furnished with two long, thick-rimmed, lateral teeth. The operculum is composed of two flaps, in this agreeing with Nutting's description and differing from that of Versluys (1899, p. 43), where only a single flap is mentioned.

Gonosome.—The gonangia, which are characteristic, have not been previously described. They are 1 mm. high, borne on short stalks on the front of the stem, generally one on each internode, and arise from near the base of a hydrotheca. They are strongly compressed from back to front, somewhat flask-shaped, with their greatest diameter (0.6 mm.) near the base and gradually narrowing towards the top, where a slight neck is surmounted by a flattened disc bearing two long, incurved, horn-like spines. These are placed, one on each side, immediately above the longitudinal lateral ridge formed by the compression of the gonangium. The gonangia are strongly ridged throughout, the ridges varying in number from five to eight. The gonangial contents escape through a longitudinal slit with toothed edges, stretching along the flattened top of the gonangium from "horn" to "horn."

Text-fig. 144.

Male Gonosome of *Sertularia versluysi*.

ap., aperture with toothed lips through which gonangial contents escape; *w.*, wall of gonangium; *gub.*, gubernaculum; *sp.*, spermary; *col.*, central column of gonophore; *gon.*, gonophore; *ect.*, ectoderm; *end.*, endoderm; *blst.*, blastostyle.

A peculiar modification was noted in one of the specimens examined, where the distal and posterior portion of a branch-internode had become free and was prolonged into a straight

sharp spine lying almost parallel to the continuation of the branch. The spiny appearance of the branch-bearing processes of the stem when denuded of their branches is also noteworthy (cf. Allman, 1888, p. 72).

Locality. Porto Praya, Cape Verde Islands: piles of pier; 12th August, 1904.

Other localities:—Off. Bermuda, 30 fathoms ('*Challenger*'); Cape Verde Islands, 25 metres (*Versluys*); on floating gulf-weed ('*Albatross*'); N.W. of Cape Blanc (Soudan), in 55 to 60 metres (*Billard*, 1906).

In the colonies examined, the gonophores were all male and in an advanced stage of development. Their structures resemble those of *Sertularia pumila* as described by Nutting (1904, pp. 26 *et seq.*), but in most, owing perhaps to the advanced stage of the gonophore, the blastostyle is comparatively small, and in no case could be observed to terminate in a thickened plug or "Deckenplatte." On the other hand, delicate strands of ectoderm stretched from the outer coat of the gonophore to the gonangial wall, to which they were attached, thus mooring the gonophore within the gonangium. Nutting, who also has found similar "gubernacula" in a male gonangium but arising from a sperm-bearing blastostyle instead of from a true gonophore, suggests that they may connect the ectoderm of the blastostyle, or in this case of the gonophore, with a delicate ectodermal layer which in some cases lines the inside of the gonangial walls (Nutting, 1904, p. 29). In these specimens I have been unable to detect the presence of an ectodermic gonangial layer such as Nutting describes. He also suggests that they may possess the nutritive function attributed by Weismann (1883) to the gubernacula of "*Sertularia pumila*."

SERTULARIA LEVIMARGINATA, sp. n. (Plate XXVI, figs. 5 & 6.)

Several minute colonies, less than 3 mm. in height, spring from a creeping hydrorhizal tube which ramifies over a polyzoan-encrusted frond. The stems are unfascicled and unbranched and are divided into distinct internodes, about 0.3 mm. long, which become much constricted in the neighbourhood of the nodes. The portion of the stem proximal to the first distinct node, which slopes at a high angle from back to front, is athecate, but each internode bears two opposite hydrothecæ towards its distal end.

The hydrothecæ rest upon a bulging portion of the internode and are somewhat ventricose, the bulging portions meeting on the front of the stem, but being slightly separated, for 0.01 mm., behind. For less than half their height they are adnate to the stem, but the distal portion (about 0.28 mm. in length) bends sharply outwards, so that the apparent upper sides form an almost straight horizontal line. The free portion becomes gradually constricted and tube-like towards the margin, which is smooth and is characterised by a shallow sinus on its upper edge at the base of which is attached a disc-shaped adcauline operculum

This operculum is frequently drawn within the hydrotheca. The aperture faces obliquely upwards.

The gonosome is absent.

Locality. Creeping upon a leaf found in one of the bottles containing Mr. Crossland's collection of tunicates from Mattiotta, St. Vincent Harbour, Cape Verde Islands.

The peculiarly shaped hydrothecæ in the present specimen bear some resemblance to those of *Sertularia lucernaria* Kirchen. 1864; but in that species the aperture is almost horizontal, with a very distinct margin, the hydrothecæ are widely separated, and the colonies are branched, with a bushy habit of growth, altogether different from the minute, simple, and scattered colonies of *S. lævmarginata*.

Family PLUMULARIIDÆ.

PLUMULARIA HALECIOIDES Alder 1859.

This species is represented by a few specimens, attaining a maximum height of 2.5 cm., which agree closely with the description of Hincks (1868). The following variations from and additions to that description were noted:—The branches, which are rare and may arise on any side, spring in the specimens examined, not from the original hydroclade-bearing tube, but from one of the secondary tubes of the stem-fascicle; the hydroclades bear up to six hydrothecæ in place of Hincks's maximum of four; intermediate athecate internodes are not always present between thecate internodes, thus in 100 internodes examined only 31 were athecate and intermediate, a pair of the latter rarely occurring together; the gonangia, for the most part strongly ringed, occur not only on the stem but also on the hydro-rhizal tubes. Similar variations have been noted by Billard (1904, pp. 181 *et seq.*) in specimens from the French coast and from Algeria.

Locality. St. Vincent, Cape Verde Islands: growing on the bottom of a lighter; 20th July, 1904. Also found on 22nd July, 1904, by diving among coral in a depth of 2 fathoms.

MONOSTECHAS QUADRIDENS (McCrady 1857). (Plate XXV. fig. 4.)

Two colonies have been referred to this species. They differ markedly in size and habit from the flabellate, dichotomously branched, 6-inch high specimens described by Nutting (1900, p. 75); for they are unbranched and but 1 cm. in height. Nevertheless the minute structure agrees so closely with Nutting's descriptions and figures, that I cannot regard these specimens as specifically distinct. I noted, however:—(1) The peculiar manner in which the hydroclades arise from the stem. The distal portion of the stem-internode bends over towards the anterior aspect of the stem, and to the end of this bent portion the hydroclade is attached by a slanting node; while from the posterior

portion of the bend a second stem-internode arises, at an angle with the first. Each hydroclade lies in a line with the stem-internode from which it arises, and from the posterior aspect of which the succeeding stem-internode is thrown off at an angle (Pl. XXV. fig. 4). The structure of the colony thus comes to resemble that of a helicoid cyme. (2) An unprotected sarcostyle, not mentioned by Nutting, issues from the angle between the hydrotheca and its internode. The arrangement of the nematophores agrees with that in Nutting's figure, pl. xiii. fig. 2, except that the supracalcine nematophores more closely resemble those in fig. 4, scarcely reaching the margin of the hydrotheca. On the stem-internodes, of which there are only four in our largest specimen, the nematophores vary from 3 to 5.

Gonosome not present.

Locality. St. Vincent, Cape Verde Islands, 15 fathoms; 30th July, 1904.

In the collections made by Professor W. A. Herdman, F.R.S., in connection with the Gulf of Manaar Pearl Fisheries Investigations, small specimens of this species occur similar in size to those above described—"half an inch is the height of the largest colony" (Thornely, 1904, p. 120).

AGLAOPHENIA MARGINATA, sp. n. (Plate XXIV. figs. 7, 8, 9, 10.)

Slender, monosiphonic colonies reaching a height of 6 cm. The normal condition of the colonies is simple, for in only one specimen was a branch found, springing from the anterior surface of the stem. The stem is divided into internodes, 0.5 mm. in length, each bearing a hydroclade on a prominent, rounded and perforated process lying midway between the nodes. The hydroclades are short, generally less than 3 mm., set forward on the stem, alternate, and divided into internodes 0.35 mm. long, each of which bears a hydrotheca. Two internodal septa are present, one proximal and opposite the intrathecal septum and extending completely around the internodal wall; the other distal and less pronounced, opposite the base of the supracalcine nematophores, and sloping slightly upwards.

The hydrothecae are small, 0.25 mm., closely approximated and rather deep, with a concave anterior profile, and a slightly oblique margin marked by nine teeth, which increase in size towards the anterior of the calycle. A distinct, horizontal septum traverses the hydrotheca cavity about a fifth from the base. The supracalcine nematophores are small, just reaching the level of the hydrotheca margin. The mesial nematophore is adnate for little more than half the height of the hydrotheca, and has but a short divergent "beak" free. There are two nematophores on each stem-internode, one opposite, the other distal to, the hydroclade-bearing process.

The stem is of a horny-brown colour, which fades into a faint yellow towards the tip.

Gonosome.—The corbulae are about 1.7 mm. in length by 1 mm. in breadth, elongate-oval in shape, with 7 or 8 pairs of corbulae-

leaves, which are altogether free from one another. Every leaf bears a row of 6 or 7 large bulging nematophores on each margin. The *cœnosarc* from which the portions supplying these nematophores branch off runs up one side of the leaf, sending off as it passes a short process into each nematophore on that side, and then, having passed a considerable distance up the leaf, sends off a larger shoot which, running backwards, supplies the nematophores along the other side. Conforming with this branching of the *cœnosarc*, the *cœnosarc*-containing cavity in the leaf also shows a backward-running branch connected with the nematophore-cavities along one side (*vide* Pl. XXIV. fig. 10). Without the walls of this cavity there is a delicate chitinous membrane connecting the nematophores and forming a wing-like extension to the body of the leaf proper. The specific name *marginata* indicates the presence of this extension. At the base of each leaf along only one side of the corbula there is a very small spur-like nematophore.

Locality. Growing on the bottom of lighters: St. Vincent, Cape Verde Islands; 20th and 30th July, 1904.

LYTOCARPUS GRANDIS, var. UNILATERALIS, var. n. (Plate XXV. figs. 1, 2, 3.)

Many much-branched colonies have been obtained from one locality: the largest, which is fragmentary, is 20 cm. in height, with a stem 6 mm. in diameter above the first branch, and a large basal portion covered with loose hydromorphous tubes.

The stem is strongly fascicled and is divided near the base into several large branches, which bear smaller branches and so on sometimes to the sixth order. All the branches, except the smallest, spring from their parent branch on the side remote from the stem, a rather unusual arrangement to which the variety owes its name. The hydroclade-bearing tubes are divided into regular internodes, 0.4 to 0.5 mm. in length, each of which bears an alternate hydroclade almost on its anterior surface.

The hydroclades, which are borne on a perforated process of the internode, are about 8 mm. long, and are divided into internodes 0.35 mm. in length, each with two very strong septal ridges, one opposite the intrathecal ridge and horizontal, the other less distinct opposite the base of the lateral nematophores and sloping obliquely upwards.

The hydrothecæ are closely approximated, deep, slightly bulging below, with nine teeth, seven of which are apparent while one on each side is hidden by the lateral nematophore. The anterior tooth is slightly recurved. The intrathecal ridge is distinct and is horizontal, extending around the hydrotheca about $\frac{1}{2}$ from the base. The mesial nematophores are long, adnate almost to the top of the hydrotheca and then free for some distance. The free portion varies much in length, sometimes scarcely rising above the hydrotheca on the proximal end of a hydroclade while overtopping those on the distal portion for a considerable distance (*cf.* Pl. XXV. figs. 2 & 3). In the supracalyceine nematophores

the same variability occurs, those on the proximal hydrothecæ rising just clear of the margin, those in the distal produced into long, prominent "horns" reaching 0.1 mm. beyond it. They have two apertures, one terminal, the other lateral and just above the hydrotheca margin. The cauline nematophores, of which there are two on each hydroclade-bearing internode, one on a level with, the other proximal to, the base of the hydroclade, are large, from 0.1 to 0.2 mm. in height, and triangular.

The colonies are of a rich dark brown colour which, however, is almost lacking in the more delicate hydroclades.

The gonosome is not present.

The specimens here described, although they differ from *L. grandis* (Clarke, 1879) in their unilateral mode of branching, agree so accurately with the minute structure of hydrotheca and branch as described and figured by Versluys (1899, p. 51), that they have been referred to that species. The black granular pigment-cells observed by Nutting (1900) in the cœnosarc of *L. grandis* and *L. clarkei* are present in considerable numbers in my specimens. The branching here described is similar to that of *L. racemiferus* of Allman (1883), but the specimens differ in the greater length of the hydroclades, the bulging shape of the hydrothecæ, the number of marginal teeth (apparently only five in Allman's figures), and the presence of a distal internodal septum. Allman does not mention the presence of cauline nematophores in his species.

Locality. St. Vincent, Cape Verde Islands: depth 15 fathoms; 30th July, 1904.

LYTOCARPUS CROSSLANDI, sp. n. (Plate XXIV. fig. 11; Plate XXVI. figs. 2, 3, 4.)

Colonies unbranched, springing from a creeping hydrorhiza and attaining a height of about 15 mm. The stem is monosiphonic, divided into regular internodes 0.3 mm. in length, except the proximal millimetre which is undivided, and which is separated from the remainder by a deep constriction sloping downwards from posterior to anterior. The hydroclades, which are borne on each internode, are placed anteriorly on the stem and are approximate and alternate. They are divided into regular internodes 0.25 mm. long, each of which bears on its anterior surface a hydrotheca, and contains two septal ridges, one opposite the intrathecal ridge, the other under the lateral nematophores. In no case was a third septum, between the other two, observed.

The hydrothecæ are closely approximated, and are marked in front by a deep fold which brings the aperture into a vertical position. The margin has anteriorly a strong, sharp, upturned tooth and on each side a prominent lobe, while the interior is divided into two regions by an intrathecal ridge projecting forwards from the internode about 0.5 mm. from the bottom. A second stout intrathecal ridge projects backwards into the hydrotheca from between the mesial nematophore and the margin.

The mesial nematophore is long (almost 0.3 mm.), reaching 0.05 mm. above the level of the hydrathecal margin, adnate for little more than half its length, and with two apertures. The supracalcine nematophores are divergent, long and tubular, inclined at an angle similar to that of the mesial nematophore, and rising a short distance above the margin of the hydrotheca, to which they are adnate. On each stem-internode there are two triangular nematophores, one proximal, the other distal to the base of the hydroclade, while the base itself bears anteriorly a tubular nematophore.

Gonosome.—The gonangia are borne on modified recurved hydrocladia, divided into about ten short internodes, the proximal bearing a hydrotheca, which is replaced on the following two or three internodes by a gonangium. Each of the remaining internodes bears one or two divergent tubular nematophores, each with two apertures, one terminal, the other in the angle formed between nematophore and internode. The gonangia are almost circular, and are much compressed. As many as twenty-two gonangia on eight phylactocarps were counted on one specimen. The arrangement of the nematophores on the phylactocarp suggests that which occurs in connection with the hydrothecæ, two divergent nematophores frequently occurring at the same level and beneath them a single mesial nematophore.

Locality. Growing on a leaf found in a bottle containing tunicates from Mattiotta, St. Vincent Harbour.

The trophosome of the present species is almost identical with that of *Aglaophenia plumosa* Bale (1884), but there the recurved gonangial pinna bears "15-20 pairs of alternate pinnules," these again bearing the nematophores which are arranged differently from those in the specimen before me, the whole structure forming a corbula.

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EXPLANATION OF THE PLATES.

PLATE XXIII.

- Fig. 1. *Coryne* (?) *dubium*, sp. n. A complete colony to show abundance of branching. $\times 4$. (p. 491.)
2. *Coryne* (?) *dubium*, sp. n. Fragment, showing polyps and origin of branches. $\times 30$. (p. 491.)
3. *Campanularia mutabilis*, sp. n. Specimen from St. Vincent, with regenerated margin. $\times 20$. (p. 504.)
4. *Campanularia mutabilis*, sp. n. Specimen from St. Vincent, showing asymmetry. $\times 20$. (p. 504.)
5. *Campanularia mutabilis*, sp. n. Specimen from Porto Praya. $\times 20$. (p. 504.)
6. *Hydractinia verdi*, sp. n. Portion of colony with polyps in various states of contraction. $\times 20$. (p. 498.)
7. *Hydractinia verdi*, sp. n. Reproductive person bearing gonophores with ova. $\times 50$. (p. 498.)
8. *Potocoryne anechinata*, sp. n. Portion of colony with nutritive and reproductive person. \times circ. 30. (p. 499.)
9. *Potocoryne anechinata*, sp. n. Medusoid before it is set free. $\times 90$. (p. 499.)
10. *Potocoryne anechinata*, sp. n. Chitinous tubes forming mesh-like basal expansion. $\times 25$. (p. 499.)
11. *Ophiodes caciniiformis*, sp. n. Colonies creeping upon fragment of worm-tube. Nat. size. (p. 500.)
12. *Ophiodes caciniiformis*, sp. n. General structure of colony. $\times 15$. (p. 500.)

PLATE XXIV.

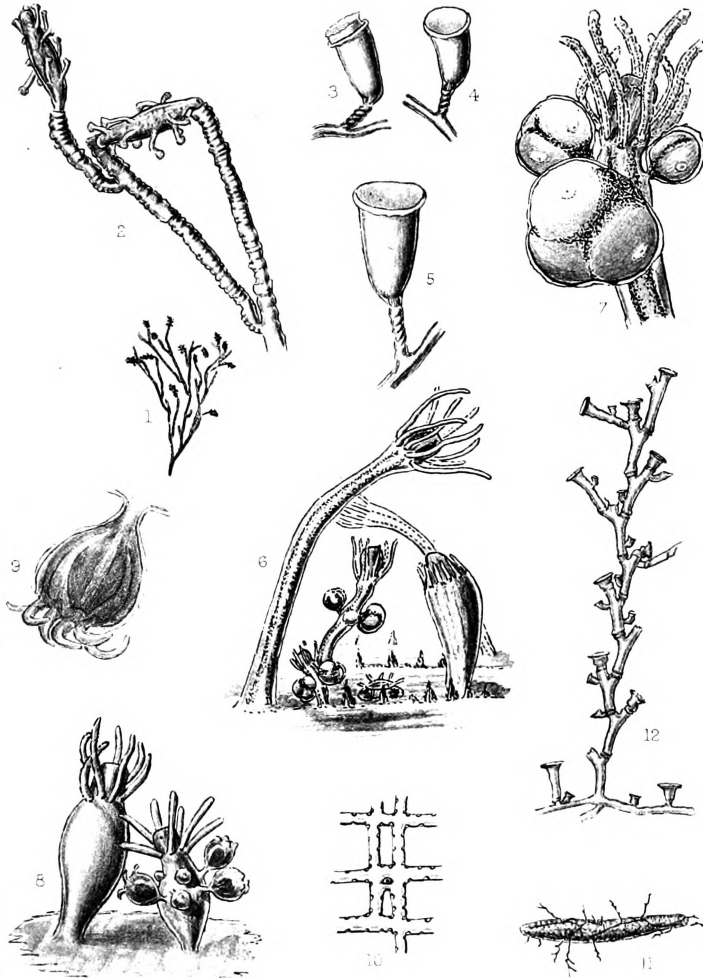
- Fig. 1. *Ophiodes caciniiformis*, sp. n. Hydranth, hydrotheca nematophore, &c. $\times 40$. (p. 500.)
2. *Sertularia versluysi* Nutt. Cluster of colonies. Nat. size. (p. 505.)
3. " " Fragment of colony showing arrangement of branches. $\times 14$. (p. 505.)
4. " " Hydrothecæ from front. $\times 50$. (p. 505.)
5. " " Hydrothecæ from side. $\times 50$. (p. 505.)
6. " " Gonangia. $\times 25$. (p. 505.)
7. *Aglaophenia marginata*, sp. n. Colonies. Slightly reduced. (p. 509.)
8. " " Hydrothecæ. $\times 50$. (p. 509.)
9. " " Corbula. $\times 40$. (p. 509.)
10. " " Leaf of corbula. $\times 70$. (p. 509.)
11. *Lytocarpus crosslandi*, sp. n. Colonies on leaf. Nat. size. (p. 511.)

PLATE XXV.

- Fig. 1. *Lytocarpus grandis*, var. *unilateralis*, var. n. Fragment of colony showing mode of branching. Nat. size. (p. 510.)
2. *Lytocarpus grandis*, var. *unilateralis*, var. n. Hydrothecæ from base of a hydroclade. $\times 50$. (p. 510.)
3. *Lytocarpus grandis*, var. *unilateralis*, var. n. Hydrothecæ from tip of a hydroclade. $\times 50$. (p. 510.)
4. *Monostæchas quadridens* (McCrady). Showing cyme-like origin of stem-internodes. $\times 20$. (p. 508.)
5. *Ophiodes caciniiformis*, sp. n. Protruded nematocyst. $\times 700$. (p. 501.)

PLATE XXVI.

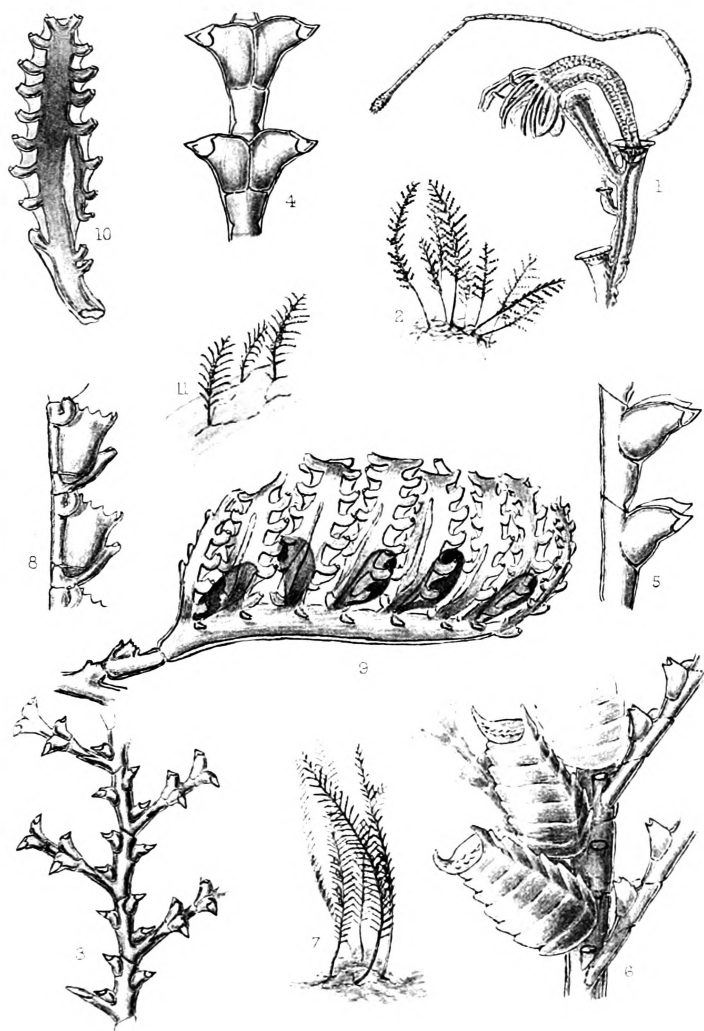
- Fig. 1. *Soleniopsis dendriformis*, gen. et sp. nov. Colony. Nat. size. (p. 495.)
2. *Lytocarpus crosslandi*, sp. n. Phylactocarp, with single gonangium. (p. 511.)
3. " " Phylactocarp. $\times 45$. (p. 511.)
4. " " Hydrothecæ. $\times 60$. (p. 511.)
5. *Sertularia lævimarginata*, sp. n. Colonies on a leaf. Nat. size. (p. 507.)
6. " " Hydrothecæ. $\times 60$. (p. 507.)



Das Fische del

Lunden, Copenhagen, 1891

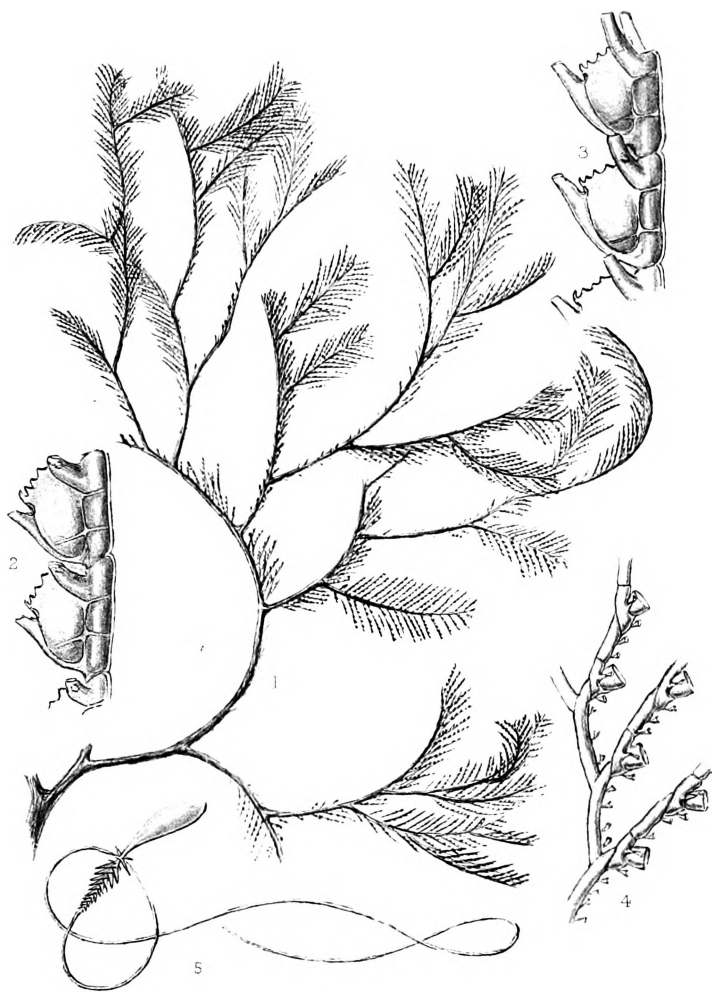
HYDROIDS FROM CAPE VERDE ISLANDS



das Ritchie, del.

Londre: Dorey, 1897, 2e. m.

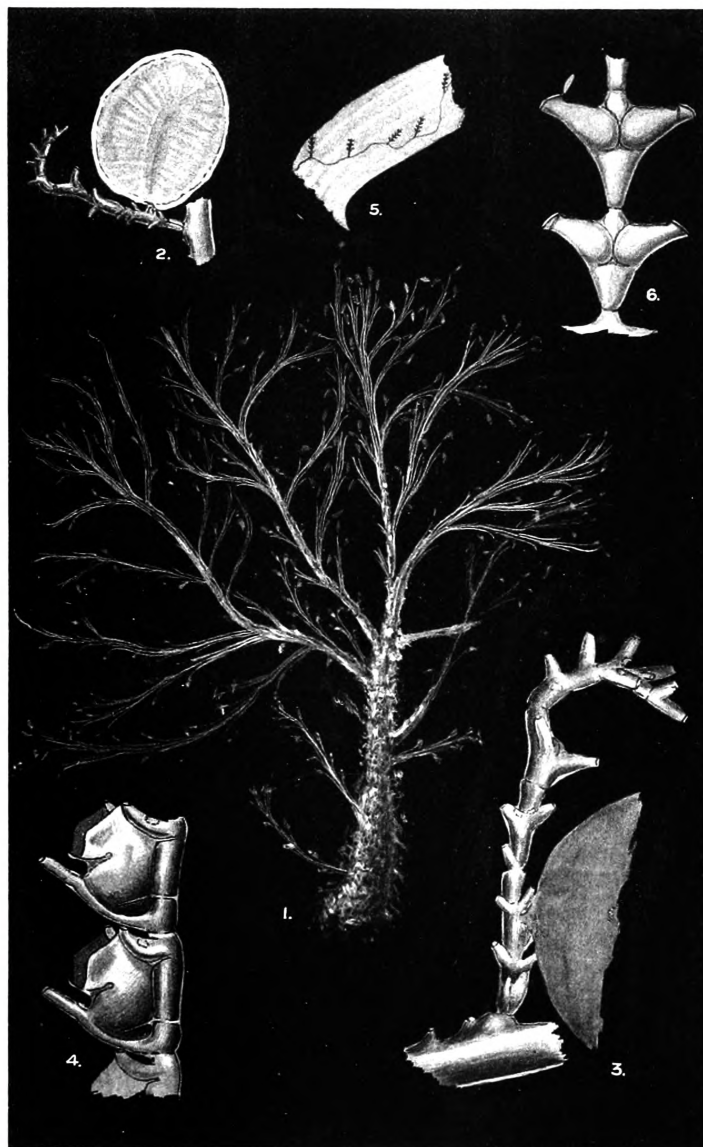
HYDROIDS FROM CAPE VERDE ISLANDS



Jas. Ritchie, del.

London Stereoscopic Company

HYDROIDS FROM CAPE VERDE ISLANDS



Das Kitzchen der

London (Dermatophyllum) Young

HYDROIDS FROM CAPE VERDE ISLANDS

XI. *A large Tubularian (Tubularia regalis, Boeck) from the Moray Firth.* By Prof. J. ARTHUR THOMSON, M.A.

(Read 16th December 1907.)

On 23rd March 1907, the "Goldseeker," engaged in the international scientific exploration of the North Sea, dredged from a depth of 39 fathoms in the Moray Firth (58° N., 2° 38' W.) a magnificent colony of a species of *Tubularia*, which seems to be an addition to the list of British Hydroids. Through the kindness of Prof. D'Arcy W. Thompson, C.B., I obtained the specimen for examination, and my conclusion is that it is referable to *Tubularia regalis*, described in 1859 from Spitzbergen by Chr. Boeck.

The beautiful cluster of polyps is about a foot in height, and strikes one at once as larger and more substantial than similar clusters of the common *Tubularia indivisa*, which it resembles in general colouring. The height of a single hydrocaulus, measured apart from the interlaced tangle at the base, varies from 7-10 inches, and to this the large hydranth may add nearly another inch (20-22 mm.). The breadth of the hydrocaulus is about 3 mm., and the largest hydranth at its broadest part has, in the contracted preserved state, a width of about 20 mm. There are 12-15 longitudinal lines on the clear perisarc, corresponding to vermilion lines on the cenesarc which shine through.

There are 32-36 proximal tentacles from 12-22 mm. in length, and the maximum spread of the tentacles, measured along a diameter of the circle which they form, is about 60 mm. The distal tentacles form a dense brush, consisting of several close tiers around the mouth. From 76 to 92 were counted on various hydranths. Each distal tentacle is about 4 mm. in length, 0.4 mm. across the base, tapering to 0.1 mm. at the tip.

Immediately above the bases of the proximal tentacles, 12 to 14 unbranched blastostyles or pendulous racemes

of gonophores are inserted. They hang down, regularly interpolated, among the proximal tentacles, which they equal in length (12-22 mm.). On several of these pendulous racemes, 48 gonophores were counted. The gonophores are oval in form, with average diameters of 1 mm. and 2 mm. Some of them show a very long spadix, but there is no trace of radial canals.

The question of present interest is, To which species of *Tubularia* does this magnificent Moray Firth specimen belong? We may at once dismiss the small species, such as *T. larynx* and *T. bellis*, and confine our attention to those which are often or usually over 6 inches in length, namely, *T. regalis*, Boeck, *T. indivisa*, L., *T. variabilis*, Bonnevie, and *T. insignis*, Allman.

Taking the last first, we find that, according to Allman, the hydrocaulus of *T. insignis* attains a height of 7 inches or more. Indeed, the monographer notes that "it far surpasses in size every British representative of the genus." But the hydrocaulus of our Moray Firth specimen may attain a height of 10 inches. The hydranth of *T. insignis* (which was found at Dieppe) was about half an inch in height from base to summit, but several hydranths in our specimen originally stood up for nearly an inch. We mention these facts to emphasise the large dimensions of our specimen. We need not, however, delay over *T. insignis*, for besides differing markedly as regard its tentacles, it is removed from any close systematic proximity to our specimen by more important differences relating to the blastostyles. In *T. insignis* the blastostyles are "in six or seven imbricated verticels, with about twenty in each verticel, not pendulous," whereas our specimen has 12 to 14 pendulous blastostyles.

The next on the list is the large *T. variabilis*, Bonnevie, which has a height of 100-300 mm., distinct longitudinal striping, 25-35 proximal tentacles (15-20 mm. in length), 10-20 blastostyles (20 mm. in length), and is thus in many respects like our specimen. But it again may be left out of account, since its gonophores are characterised by 3-6 high external ribs corresponding to a similar variable number of

radial canals, whereas the gonophores of our specimen have no ribs and show no radial canals. For similar reasons, we need not consider either *T. asymmetrica*, Bonnevie, or *T. obliqua*, Bonnevie, which have rudimentary tentacles on the gonophores.

Is it then possible that the Moray Firth specimen is simply a very large and luxuriant representative of the common *T. indivisa*, perhaps like the vaguely known *T. gigantea* of Lamouroux, which attained a height of 12-15 inches, and was regarded by Allman as "probably only a large form of *T. indivisa*"? If the radial canals are absent from the gonophores of the Moray Firth specimen, as they appear to be, then it cannot be identified with *T. indivisa*, whose gonophores have four radial canals; but it seems undesirable to press this point, since our specimen has not been adequately fixed. The difficulty of deciding whether our specimen is or is not referable to *T. indivisa* is complicated by the fact that there are considerable differences between Allman's and Hincks's descriptions. The real difficulty is that we cannot judge as to the specific value of numerical and quantitative differences without examining a large number of specimens, which we have not, as yet, been able to do.

It may be pointed out that the difference between Allman's "40 distal tentacles" and our 76-92 is very considerable, but Hincks simply says "very numerous." Similarly, the difference between Allman's "3 or 4 pendulous racemes of gonophores" and our 14 is also very considerable, but again Hincks says "numerous." On the whole, however, the numerical and quantitative differences seem to warrant us in separating our specimen from *T. indivisa*, and it seems to us that it should be referred to Boeck's Spitzbergen species, *T. regalis*.

In contrasting *T. indivisa* and *T. regalis*, Miss Bonnevie notes that the former has 4 radial canals on its gonophores, while the latter has none; that the former has 20-30 proximal tentacles, about 10 mm. in length, while the latter has 20-30, 20-40 mm. in length; that the former has 3-10 blastostyles, while the latter has 10-20, 35 mm. in length.

Our specimen resembles *T. regalis* (1) in having bright red longitudinal lines on the cœnosarc, which are seen shining through the clear perisarc; (2) in the breadth of the hydrocaulus (3 mm.); (3) in the great height and breadth of the hydranth; (4) in the length of the proximal tentacles (up to 22 mm.); (5) in the length of the distal tentacles (3-4 mm.); (6) in the shape and arrangement and length of the blastostyles; (7) in the long spadix within the gonophores; and (8) in showing no trace of radial canals.

Our specimen differs from *T. regalis*, as described by Boeck, (1) in having 32-36 proximal tentacles instead of 28, but Bonnevie says 20-30; (2) in having shorter proximal tentacles and blastostyles, 12-22 mm. instead of 42-45 mm., but Bonnevie gives 20-40 mm. as the length of the tentacles and 35 mm. as the length of the blastostyles. It should also be noted that our specimen was considerably contracted by preservation before the measurements were taken. Boeck figured the blastostyles as if they stood up vertically, but Allman pointed out that this position is impossible.

Before giving a tabular comparison, which will show the resemblances and differences at a glance, we may supplement the descriptions of *T. regalis* by a reference to the hydro-rhiza, which was absent in the specimens obtained by the Norwegian North Atlantic Expedition, and was left unnoticed by Boeck. As Miss Bonnevie supposed, the lower part of the hydrocaulus is composite, as in *T. indivisa*. The stems are twisted together in a tangle at the base. It may also be noted that one hydrocaulus bears a small barnacle, *Scalpellum vulgare*.

Species.	Hydrocaulus.	Hydranth.	Proximal Tentacles.	Distal Tentacles.	Blastostyles.	Gonophores.	
<i>T. indivisa</i> (as described by Albin).	Ht. 76-226 mm. Br. 2-5 mm.	....	20-30.	40.	3 or 4 pendulous racemes surpassing the hydranth in length.	Oviform, without tentaculiform tubercles; 4 radial canals.	
<i>T. indivisa</i> (as described by Hincks).	Ht. 150-300 mm.	....	About 40.	Very numerous.	Gonophores on branched peduncles, forming large and very numerous clusters.	With four radiating canals, and four small tubercles at their terminations.	
<i>T. indivisa</i> (as named up by Bonnetie).	Ht. 109-300 mm. With longitudinal striping, no collar.	....	20-30, about 10 mm. long.	Several circles, very close together; 2-3 mm. long.	3-10, male longer than female.	No tentacles; 4 radial canals.	
<i>T. ventris</i> (as described by Bock).	Ht. 120-130 mm. Br. over 3 mm. With longitudinal bright red stripes.	18 mm. in height.	28-42-45 mm. in length, with a maximum spread of 80-85 mm.	Very numerous; 3-4 mm. in length.	Simple racemes, equal in length to the proximal tentacles, and alternating with them.	Oviform, without tentaculiform tubercles, with a long spadix.	Near Spitzbergen.
<i>T. ventris</i> (as described by Bonnetie).	Ht. 109-300 mm. With longitudinal striping, no collar. The actual stems measured were over 200 mm. in length.	Hydranths measured about 7 to 9 cm. beyond (across?) the proximal tentacles.	20-30, 15-40 mm. long; also stated as 20-40 mm. long.	Several circles, very close together; 2-3 mm. long.	10-20; length 35 mm. in a circle just within that of the proximal tentacles.	No tentacles; no radial canals.	72° 27' N., 30° 51' E.; 349 metres. 76° 34' N., 12° 51' E.; 1359 metres.
The Moray Firth Specimen.	Ht. 175-250 mm. Br. 3 mm. With about 15 bright red lines on the dorsum, the shining, though the clear perisarc.	20-22 mm. in height; 20 mm. in maximum breadth.	32-36, 12-22 mm. in length, with a maximum spread of about 60 mm.	76-92; 4 mm. in length.	12-14 pendulous simple racemes, 12-22 mm. in length.	Oviform, without tentacles; apparently without radial canals, with a long spadix.	58° N., 3° 38' W.; 39 fathoms.

The results of this short note on a very beautiful specimen may be summed up in a sentence. There exists in the Moray Firth a large species of *Tubularia*, differing considerably from the familiar *T. indivisa*, and closely resembling *T. regalis*; if it be referred to the latter, as seems justifiable, a new record is made for British waters, and a distinctively northern form, previously recorded from near Spitzbergen and from far to the north of Norway, is shown to have an interesting extension of its range southwards.

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XVII. *Note on a Large Antipatharian from the Færoes.*
 [Plate XI.] By Prof. J. ARTHUR THOMSON, M.A.

(Read 24th February 1908.)

In the summer of 1907 I obtained from Mr George Sim, Aberdeen, a remarkable specimen which had been brought in by a trawler "from the north-east of the Færoe Islands." It was remarkable in being an Antipatharian, for the occurrence of a representative of this order in northern waters near Britain was, to say the least, unexpected. It was remarkable in the second place, because of its huge size, for it stood over a yard in height. I wish to take this opportunity of thanking Mr Sim for his kindness in allowing me to have this interesting specimen for the University Museum. This is indeed but a minor instance of the disinterested way in which the indefatigable and learned author of *The Vertebrate Fauna of Dee* has placed valuable material, as well as knowledge, at the service of scientific workers in many departments of Zoology. A word of appreciation may also be permitted in reference to the sagacity of the fisherman who recognised that the Antipatharian was "something new," and took the trouble to bring the large specimen home.

The specimen stands 3 ft. $2\frac{1}{2}$ ins. high, and consists of a substantial main stem with more than half a dozen strong branches. It is attached by a broad base ($1\frac{1}{2}$ ins. \times $1\frac{1}{2}$ ins.) to a stone which measures $9 \times 7 \times 3\frac{1}{2}$ ins. and weighs several pounds, so that all thought of the specimen having been washed from elsewhere is out of the question. The main stem has for the greater part of its length a diameter of about 8 mm., and its section shows the well-known characteristics of "black coral." Five branches which remain fairly complete attain a very considerable length, the longest being almost as long as the main stem (2 ft. 8 ins.). It should be noted that the intact specimen must have been much more than a yard in height, for the main stem is broken off while still showing a diameter of about 7 mm.

There have been at least eight fairly strong primary branches, arising irregularly and at various angles from the main stem, and one of these which was broken off, and was heavily weighted with large clusters of barnacles (*Scalpellum vulgare*), had an irregularly elliptical section, about 8 mm. by 6 mm. From the strong primary branches a few secondary branches arise, and all the branches bear very numerous twigs or pinnules, with which the main stem was also beset, as the more or less broken stumps plainly show. The twigs or pinnules arise on all sides of the primary and secondary branches in somewhat irregular vertical rows. They arise for the most part at right angles, and in some parts there are rather vague indications of six vertical rows. As many as forty-eight pinnules may occur on a centimetre, and thus a dense bottle-brush appearance results. The twigs or pinnules have a thread-like axis (0.18 mm. in diameter), and stand out stiffly, but they are as flexible as a fencing-foil.

Only a few spines were seen on the branches, but they occur in typical abundance on the delicate twigs. Three rows are fully visible on one aspect, and there are actually six vertical rows. These spines are minute, fairly sharp triangles, curved slightly upwards and not closely appressed. In many cases they project for 0.09 mm., but they are not all of the same size. Those observed on the branches are larger but lower than those on the pinnules, and even on the same pinnule there is some inequality. The distance between two adjacent spines on a vertical row varies from 0.5 to 0.75 mm., and is by no means regular.

The reason for these details will be obvious when I mention the unfortunate fact that not a word can be said in regard to the polyps of this interesting specimen. When it came into my hands, it showed abundant remains of the coenenchyma, but no definite trace of any of the polyps could be found. Two or three of the best pieces were immediately fixed, but they only showed that the polyps were hopelessly decomposed. This is peculiarly unfortunate, because it is very difficult to identify an Antipatharian apart from its polyps.

In the absence of any polyps, I could not do more than give close attention to the mode of branching, the arrangement of the twigs, and the disposition and character of the spines. By comparing the Færoe specimens with others, and by following a method of exclusion, I have convinced myself that it is referable to the well-known Mediterranean species—*Parantipathes larix* (Esper), see Brook (1889, p. 142). If this conclusion is correct, the occurrence of this species to "the north-east of the Færoe Islands" is of great interest, which is increased by Professor Hickson's record (1907) that *Parantipathes larix* was collected by the "Huxley" from the north side of the Bay of Biscay in August 1906.

Recognising the scientific responsibility of stating that a well-known Mediterranean species occurs in such high latitudes as north-east of the Færoes, I have carefully considered all the Antipatharians in Brook's "Challenger" Report and in subsequent publications, and I find that, apart from *Parantipathes larix*, there is only one other Antipatharian which the Færoe specimen resembles in any marked degree, and that is *Taxipathes recta*, Brook (1889, p. 156), which is only known by a single specimen, obtained off Ascension. That this species cannot include the Færoe specimen might perhaps be inferred from the distribution, but as that is a dangerous way of arguing, I may point out that, while *Taxipathes recta* resembles *Parantipathes larix* and our specimen in certain respects, *e.g.*, in having the same kind of delicate simple pinnules arranged in a brush in six vertical rows, it may be left out of consideration because of its extremely stiff rectangular branching, its rigid and absolutely regular pinnules (only 18 to 21 to a centimetre, moreover), and its spinulation (with four vertical rows of spines on one aspect). It need hardly be said that the presence of even a few polyps would have obviated even a minute's consideration of whether the form in question was referable to the Schizopathinae, among which *Taxipathes* is included, or to the Antipathinae, among which *Parantipathes* is included.

The real difficulty in regard to the specimen from the

Færoes is that it cannot be regarded as a typical representative of the species to which it seems most reasonably referable, namely *Parantipathes larix*. It differs from the type in having several branches from the main stem, in not having the pinnules of a row strictly in one plane, in having more numerous pinnules (over 20 in three cm. of one vertical row, instead of about 11), and in having flexible, not "rigid," pinnules. But in Brook's detailed description it is stated that the pinnules of a row are "almost in one plane," and we may also note that the pinnules of a fine specimen of *Parantipathes larix* from Naples, are anything but rigid in the sense that an icicle is rigid. They are flexible like a foil.

Our specimen agrees with *Parantipathes larix* in having the pinnules in six vertical rows (though these are decidedly irregular), in having six pinnules to one revolution of the axis, in showing three longitudinal rows of spines on one aspect of a pinnule, and in having similar spines not uniform in size. We have compared a pinnule of a Naples specimen with a pinnule from the Færoes specimen, and we find them practically identical. Therefore we conclude that the Færoes specimen is referable to *P. larix*, although it deviates from the type in certain respects, such as branching. The deviations may be growth-reactions to a very different environment.

We make no apology for entering into details on this subject of specific identification, for in all such questions one is only too apt to err in the opposite extreme. At first sight it seemed impossible to identify the weathered specimen from the Færoes with a perfectly preserved specimen from Naples, yet we think that this is necessary. This means that Brook's description of the species as (*a*) with stem "simple or rarely branched near apex," (*b*) with pinnules in six planes, and (*c*) with pinnules rigid, about 11 in each vertical row for 3 cm., requires to be modified in regard to each of these points. When we think of plants, *e.g.*, forms like "Shepherd's Purse" and "Whitlow Grass," to which the ramose colonial Cœlentera are in so many ways comparable, or when we think of

many of the hydroids, we can well understand that divergences in regard to growth-characters are to be expected between representatives of the same species of Antipatharian, living in growth-conditions so diverse as those afforded by the relatively sheltered Mediterranean and the stormy seas to the north-east of the Færoes.

In discussing North Atlantic Antipatharians, Brook noted that "*Antipathes* (?) *arctica*, Lütken, is apparently the only species which has been obtained north of latitude 47° N.; it has been obtained on two occasions off the coast of Greenland. The occurrence of *Cirripathes spiralis* (Linn.) off the coast of Norway appears to me very doubtful, and requires confirmation before the species can be admitted into the above list" (Challenger Report, xxxii., 1889, p. 182).

On this statement three notes may be made:—

- (1) Lütken's remarkable species, *Antipathes arctica*, from North Greenland, bears no resemblance to the specimen from the Færoes.
- (2) The Færoes lie between 61° and 62° N., which is far to the north of the 47° which Brook mentioned as the highest latitude known for any North Atlantic Antipatharian except Lütken's species.

In 1905 Prof. Hickson recorded the occurrence of three Antipatharians from the West Coast of Ireland (about 53° and 54° N.), but these forms have not been reported on as yet.

- (3) The three Antipatharians recorded by Prof. Hickson from the north of the Bay of Biscay, namely—*Stichopathes spiralis*, Pourtales, *Parantipathes larix*, Esper, and *Schizopathes crassa*, Brook, were not obtained from higher latitude than $48^{\circ} 7' N.$ Six specimens of *P. larix* were obtained from latitude $48^{\circ} 7' N.$, longitude $8^{\circ} 13' W.$, 412 fathoms. They varied in length from 225 mm. to 325 mm., and were therefore small in comparison to the Færoes specimen.

Of other definite records of *Parantipathes larix* I have not been able to find more than the following:—(a) in 1896 Prof. L. Roule dredged this species in the Bay of

Biscay from a great depth (1220 metres); (b) His Serene Highness the Prince of Monaco collected this species (1886-1902) from four stations, of which the farthest north was $43^{\circ} 57'$, while the nearest the equator was $15^{\circ} 17' N$. The inference seems to be that the distribution of *Parantipathes larix* is remarkably widespread. It is interesting to notice that in three of the four specimens dredged by the Prince of Monaco the polyps were absent, as in our specimen.

SUMMARY.

A large Antipatharian, over a yard in height, consisting of a strong main stem with several long branches, was trawled to the north-east of the Færoe Islands. Numerous filiform pinnules, arranged in six irregular rows, give the branches a bottle-brush appearance. The pinnules bear six vertical rows of minute triangular spines. For these reasons the specimen is referred to *Parantipathes larix* (Esper), and the reference involves a slight modification of the diagnosis of the species, as well as a great extension of its previously recorded range of distribution.

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EXPLANATION OF PLATE.

The large figure represents the complete colony of *Parantipathes loric*; the inset a portion of a branch showing pinnules.

ANTIPATHARIAN FROM FEROES



[*Extracted from the LINNEAN SOCIETY'S JOURNAL—ZOOLOGY,*
vol. xxxi. *November 1908, pp. 48-75.*]

REPORTS ON THE MARINE BIOLOGY OF THE
SUDANESE RED SEA.

VIII. THE ALCYONARIANS.

BY

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AND

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REPORTS on the MARINE BIOLOGY of the SUDANESE RED SEA.—VIII. The ALCYONARIANS. By Prof. J. ARTHUR THOMSON, M.A., and Mr. JAMES M. McQUEEN, M.A., B.Sc., University of Aberdeen. (Communicated by Professor HERDMAN, D.Sc., F.R.S., President.)

(PLATES 5-8 and 4 Text-figures.)

[Read 5th December, 1907.]

THIS collection of Alcyonarians was made in 1906 by Mr. Cyril Crossland, M.A., B.Sc., on and off the shores of the Red Sea, in the course of his investigation of the Sudanese marine fauna. The localities where he collected were :—Suakim, Khor Dongola, Mersa Makdah, Shubuk, Matala, Etuleh, Wadi Lehama, Kal el Kebira, Shab Baya, Rawaya, and Agig. The indefatigable collector has furnished us with a few notes as to the colour of some of the living animals.

The collection includes the following 26 species :—

I. STOLONIFERA.

- Clavularia pulchra*, Thomson and Henderson.
- Sympodium fulvum* (Forskål).
- Tubipora purpurea*, Pallas.

II. ALCYONACEA.

- Xenia umbellata*, Lamarck.
- „ *cærulea*, Ehrenberg.
- „ *fuscescens*, Ehrenberg.
- Alcyonium sphærophorum* (Ehrenberg).
- Sarcophytum glaucum*, Quoy et Gaimard.
- Sclerophytum gardineri*, Pratt.
- „ *querciforme*, Pratt.
- „ *densum* (Whitelegge).
- Lithophytum arboreum*, Forskål.
- „ *brassicum* (May).
- „ *thyrsoides* (Ehrenberg).
- „ *crosslandi*, n. sp.
- „ *macroscopiculatum*, n. sp.
- Nephthya zanzibarensis*, Thomson and Henderson.
- „ *albida* (Holm).
- Spongodes hemprichi*, Klunzinger.
- „ *hartmeyeri*, Kükenthal.
- „ *suesiana*, n. sp.
- „ *pharonis*, n. sp.

III. PSEUDAXONIA.

- Melitodes coccinea* (Ellis).
- „ *splendens*, n. sp.
- Clathraria rubrinodis*, Gray.
- „ *acuta*, Gray.

Order I. **STOLONIFERA**, Hickson.

CLAVULARIA PULCHRA, *Thomson and Henderson* (1906).

See J. Arthur Thomson and W. D. Henderson: "Alcyonaria of Zanzibar and British East Africa from Collections made by Cyril Crossland," *Proc. Zool. Soc.* 1906, p. 405.

A large colony growing on a pearl-oyster shell and on the stone to which the shell is attached.

The polyps, which arise from a strong basal membrane, are large and substantial; the body varies from 10 to 30 mm. in length, and from 2 to 3.5 mm. in breadth; the tentacles are 5 to 10 mm. in length. There is a very marked hypostome, about 1 mm. high. There are 28 pinnules on each side of a tentacle, and they are for the most part very long and slender. In some cases, however, they are almost wart-like. This diversity depends in this case on the degree of contraction.

The whole surface of the colony glistens with calcareous rods; the following measurements were taken of their length and breadth in millimetres:— 0.054×0.018 ; 0.09×0.02 .

Locality.—Khor Dongola, 10 fathoms; previously recorded from Zanzibar shore.

SYMPEDIUM FULVUM (*Forskål*).

= *Lithophyton fulvum*, *Forskål* (1775).

Sympodium fulvum, *Ehrenberg* (1884).

See W. May: "Beiträge zur Systematik und Chorologie der Alcyonaceen," *Jenaische Zeitschr. Naturwiss.* xxxiii. (1899) p. 52.

W. Kükenthal: "Ueber einige Korallenthiere des roten Meeres," *Festschrift von E. Haeckel*, 1904, p. 41.

A large number of specimens seem to be referable to this species, the only noteworthy difference from the type being that the general spicules of the cœnenchyma are not visible to the naked eye. A characteristic feature is the armature of the polyp-body, which consists of eight double rows of spicules arranged in chevron, and with some horizontally disposed spicules at the bases of the rows. According to Kükenthal, this type should be referred to *Alcyonium*.

Locality.—Very abundant about Matala Island in Khor Dongola, one of the richest pearling shallows. Previously recorded from the Red Sea and East Africa (Tumbatu).

TUBIPORA PURPUREA, *Pallas*.

The differences between alleged different species of *Tubipora* remain in a very unsatisfactory stage of definition. Emphasis has been laid, for instance, on the number of pinnule-rows. But our specimen shows with equal clearness polypes whose tentacles have a single row on each side, and polyps whose tentacles have a double row on each side. The difference is in this case due

to the different degrees of contraction, and is therefore of no significance. We have referred the specimen to Pallas's species, *T. purpurea*. From this it does not seem to us that *T. chamissonis* can be separated.

Many of the polyps are crowded with spherical or nearly spherical reproductive bodies, most of which show an internal cavity and a wall with several layers of nuclei. The following measurements of diameters were taken in millimetres: 0.0765×0.0765 ; 0.136×0.1445 ; 0.296×0.296 ; 0.323×0.323 ; 0.34×0.351 . These will form the subject of subsequent study, along with other bodies of a similar nature which occur in various Alcyonarians. They are either young embryos or sperm-sacs.

Locality.—Outer edge of the reef (Shubuk). Previously recorded from the Red Sea, from Zanzibar (as *T. chamissonis*), and from East Indies (as *T. chamissonis*).

Order II. **ALCYONACEA**, Verrill.

XENIA UMBELLATA, Lamarek.

Numerous colonies with whitish-brown stems and chocolate-brown polyps. Many of the groups are 50 mm. in height, the stem being about 30 mm., and the polyp-bearing region about 20 mm. A common size of polyp is 10–12 mm., the tentacles and the polyp-body being each 5–6 mm. in length. The polyp-bodies and tentacles are thickly covered with glistening calcareous corpuscles. These are arranged in 8 very distinct longitudinal rows on the polyp-body. Every here and there one observes what looks with low power like a perforation about a millimetre in diameter and with a perfectly regular contour. These pore-like spots are dense colonies of zoochlorellæ. There are on each side of the tentacles four rows of long pinnules, about 18–20 in each row. There are abundant ova.

While the description just given applies to a large number of colonies, there are many others which differ markedly, *e. g.* in being much smaller, in showing no spicules or almost none, in having some reddish colour, in the number of rows of pinnules, in the total number of pinnules, and in the length of the pinnules. After a careful examination of a large number of specimens, we have come to the conclusion that these are all referable to a very variable species.

A specimen from the outer part of Suakim Harbour has a peculiar reddish colour, which Mr. Crossland noted as "not natural"; but it may be recalled that Klunzinger observed a rusty brown on the inner side of the tentacles. In this specimen the body of the polyp is about 10 mm. in length; the tentacles are about 8 mm. in length; there are slender, elongated, pointed pinnules in 2–3 rows about 12 in each row. There are very abundant zoochlorellæ, and there is not the slightest trace of effervescence when the polyp is dropped into dilute hydrochloric acid.

In the living colonies there was considerable difference in coloration:—(a) whitish stems, bluish tentacles, grey pinnules; (b) whitish-brown stems, chocolate-brown polyps; (c) whitish zooids, chocolate-brown tentacles.

Some of the colonies which seem referable to this variable species show only two rows of pinnules on each side of the tentacles, and greatly elongated tentacles appear as if they only had one row. It was easy to find tentacles with three rows of 20 pinnules, or two rows of 30 pinnules. This matter of rows of pinnules is a very untrustworthy and useless character. Young polyps occur at the bases of those fully-formed, and show various stages from minute zooid-like buds on which no tentacles are visible with low power, to small forms with distinct tentacles and pinnules, but only about a tenth the size of the ordinary polyps. Over and over again we have thought for a time that we had to do with a clear case of dimorphism of zooids, but further examination has shown that there were transitions between minute polyps showing no tentacles and others not much larger which exhibited them. Moreover, in colonies apparently identical in every other respect with those showing minute zooids without tentacles, no such zooids could be found.

Localities.—Various parts of Suakim Harbour, 1–2 fathoms. Previously recorded from Red Sea, Mozambique, Tumbatu, Zanzibar, Ceylon, Pacific Ocean (New Britain).

XENIA CÆRULEA, Ehrenberg.

A small specimen growing on a coral fragment presents some difficulty. The polyps are about 3·5 mm. in height, the tentacles are about the same. On each side of the tentacle there are 16–20 pinnules, in 2–3 rows or in one. The two lowest pinnules are small, but it cannot be said that there are two kinds of pinnules. The extended pinnules are elongated, slender, and pointed.

The tentacles and the bodies of the polyps show large numbers of zoochlorellæ. In some cases the colour remained bright green. Under low power the surface had a glistening appearance, as if dusted with refractive particles. These are zoochlorellæ, not spicules. The calcareous corpuscles are very minute and by no means abundant. The specimen may be referred to Ehrenberg's *X. cærulea*, or, what comes almost to the same thing, it may be regarded as a dwarf variety of *X. umbellata* *. In another specimen the number of pinnules on each side was 24 in two rows, the whole surface glistened with zoochlorellæ, and no effervescence was seen when the polyp was placed in dilute acid.

Locality.—Off S.E. corner of Shubuk, 9 fathoms; bottom of coarse sand, shells, and coral. Etuleh shoals in Suez Bay.

* It seems certain that *X. umbellata*, Lamarck, *X. fuscescens*, Ehrenberg, and *X. cærulea* Ehrenberg, are very closely related. It may be necessary eventually to unite them in one variable species.

XENIA FUSCESCENS, Ehrenberg.

Several colonies, showing two sizes of zooids, are referable to this species, which is closely related to *X. umbellata*, Savigny.

The larger zooids have bodies up to 18 mm. in length, with tentacles about half as long. There are about 40 long slender pinnules on each side, in two rows. There are abundant zoochlorellæ.

The small zooids are 2-4 mm. in height. They show minute tentacles, but no pinnules.

Locality.—Suakim Harbour, $\frac{1}{2}$ fathom. Previously recorded from the Red Sea, Zanzibar.

ALCYONIUM SPHÆROPHORUM (Ehrenberg).

See C. B. Klunzinger: Die Korallthiere des rothen Meeres, Part I. Die Alcyonarien, etc., 1877, p. 22.

W. May, 1899, *loc. cit.* p. 105.

The collection includes numerous specimens of this common species. In their mode of growth they more nearly resemble *A. pachyclados*, but their spicules are nearest those of *A. sphærophorum*. We see no reason for regarding these as distinct species, and we would suggest the incorporation of the former in the latter.

We are inclined to think that *A. globuliferum*, Klunzinger, *A. digitulatum*, Klunzinger, and *A. brachyclados*, Ehrenberg, should be referred, along with *A. pachyclados*, to one species—*A. sphærophorum*. As described and figured, they do not seem to us to differ in more than slight quantitative characters, which are probably not more than individual fluctuations. The specimens here referred to *A. sphærophorum* furnish all the kinds of spicules figured as distinctive of *A. globuliferum*, *A. digitulatum*, and *A. brachyclados*, though the most prevalent agree with those figured as distinctive of *A. sphærophorum*. The colour of the living specimens was "like weak cocoa" with "chocolate" tentacles. This corresponds with Ehrenberg's "polypis fuscis."

Twelve species of *Alcyonium* have been reported from the Red Sea; but there is no doubt that the list will have to be much reduced.

Locality.—From the coral shoal of Kal el Kebira in Suez Bay. Previously recorded from Red Sea, Madagascar.

SARCOPHYTUM GLAUCUM, Quoy et Gaimard. (Plate 5. fig. 5.)

See E. von Marenzeller: "Ueber die *Sarcophytum* benannten Alcyoniiden," Zool. Jahrb. i. (1886) p. 352, Taf. ix. figs. 1 & 2.

The collection includes several specimens of this species.

A typical colony consists of a stout trunk, 1.5 cm. high by 4.7 cm. broad, somewhat concealed by the overhanging much folded lobes of the capitulum. The upper surface of the capitulum is about 11.5 cm. in breadth, and the appearance presented by the convoluted and dovetailed lobes has been compared to that of a Meandrine Coral.

The autozooids are large and well-marked. Towards the periphery of the capitulum they are closely aggregated in rows parallel to the free border, the individuals of adjacent rows alternating. Towards the centre of the capitulum they become sparser. A converse distribution of the siphonozooids is to be noted.

Towards the centre the siphonozooids are very numerous; as many as 6 to 13 can be counted in a straight line between two adjacent autozooids: peripherally only 1 to 3.

The spicules agree with Marenzeller's figures.

The following measurements were taken of length and breadth in millimetres:—

Cortical spicules from the lobes of the capitulum:

Clubs: 0.22×0.06 ; 0.175×0.025 ; 0.15×0.025 ; 0.13×0.04 ; 0.1×0.015 .

Rods: 0.35×0.025 ; 0.29×0.025 ; 0.26×0.02 ; 0.21×0.025 ; 0.15×0.015 .

Spindles: 0.27×0.03 ; 0.52×0.03 ; 0.22×0.04 ; 0.17×0.02 ; 0.15×0.02 ; 0.075×0.02 .

Spicules from the autozooids:

Rods: 0.28×0.02 ; 0.27×0.02 ; 0.26×0.02 ; 0.25×0.02 ; 0.21×0.01 .

Cortical spicules from the trunk:

Tuberculate spindles: 0.8×0.15 ; 0.8×0.12 ; 0.78×0.16 ; 0.74×0.12 ; 0.68×0.14 ; 0.62×0.12 ; 0.55×0.15 ; 0.5×0.1 ; 0.47×0.075 ; 0.44×0.06 ; 0.45×0.075 ; 0.35×0.075 .

Slightly spinose spindles: 0.39×0.04 ; 0.34×0.04 ; 0.32×0.04 ; 0.3×0.06 ; 0.15×0.03 .

Clubs: 0.24×0.06 ; 0.2×0.05 ; 0.18×0.05 ; 0.15×0.03 ; 0.12×0.05 ; 0.1×0.04 .

Smooth spindles: 0.4×0.04 ; 0.275×0.03 ; 0.23×0.03 ; 0.22×0.02 ; 0.12×0.04 .

The colour in spirit is light to medium brown. Mr. Crossland notes that the colour of the living colonies was greenish brown, but that the tentacles were white in some. Consequently the fully expanded colony, seen from above, often appeared white.

Locality.—Suakim Harbour; growing in proximity to coral, Sherm Shekh. Previously recorded from Australia, Red Sea, Tonga Island, Viti Island, Maldive Islands.

SCLEROPHYTUM GARDINERI, Pratt.

See E. M. Pratt: "The Alcyonaria of the Maldives," in Gardiner, *Fauna and Geography of the Maldive and Laccadive Archipelagoes*, ii. (1903) p. 527.

Several specimens belonging to this species illustrate how a colony becomes gradually more complex in its structure with increased growth. A young colony is represented by an elliptical mass 7.5 cm. by 5.5 cm.; from its

upper surface lobes arise to a height varying from 0.5 mm. to 7 mm. The smaller lobes are wart-like. An older colony, shaped like a half-moon, carries on its convex upper surface several lobes, the largest attaining a height of 2 cm. : these lobes have numerous digitate branches up to 7 mm. in length with a breadth of about 4 mm.

The spicules agree closely with the description given by Miss Pratt (*Alcyonaria of the Maldives*, p. 527), and consist of clubs which average 0.06 to 0.1 mm. in length by 0.02 to 0.06 mm. in breadth, and spindles 0.16 to 0.2 mm. in length by 0.06 mm. in breadth.

The tuberculate spicules are about 3 mm. long and 0.8 to 1 mm. broad.

The colour of a colony in spirit is light to dark brown ; during life it was dull chocolate.

Locality.—Very abundant locally in reef gaps due south of Shubuk. Previously recorded from the Maldives.

SCLEROPHYTUM QUERCIFORME, Pratt. (Plate 8. fig. 1.)

See E. M. Pratt, 1903, *loc. cit.* p. 530.

Several fine colonies of this species are included in the collection. The specimen photographed (Pl. 8. fig. 1) has a short wrinkled and furrowed trunk, somewhat compressed laterally.

The branches come off rather abruptly from the stem and pass almost imperceptibly into a much branched capitulum.

As the photograph suggests, the colonies tend to be more complex than Miss Pratt's figure (*Alcyonaria of the Maldives*, pl. xxxi. fig. 33) would lead one to suppose.

The spicules of the capitulum are very various, comprising tuberculate spindles similar to those of the trunk though smaller, spinose spindles and clubs.

The following measurements were taken of length and breadth in millimetres :—

Spinose spindles : 0.32×0.03 ; 0.28×0.03 ; 0.25×0.03 ; 0.18×0.02 .

Clubs : 0.23×0.02 ; 0.22×0.03 ; 0.2×0.04 ; 0.18×0.02 ; 0.015×0.04 ; 0.14×0.04 ; 0.12×0.03 ; 0.08×0.03 .

The spicules of the trunk are tuberculate spindles, rarely forked, besides clubs and spinose spindles. The tuberculate spicules vary greatly in size, the largest being about 5 mm. by 0.7 mm.

The following are the measurements of the colony represented in the photograph :—Breadth of trunk at base, 3.5 cm. ; breadth of capitulum, 8.5 cm. ; height of capitulum, 4.5 cm.

The colour of the colony in spirit is light to dark brown ; when alive it was purple-slate.

Locality.—Off south-east corner of Shubuk, at a depth of 9 fathoms, on a bottom of coarse sand, shells, and coral. Previously recorded from the Maldives.

SCLEROPHYTUM DENSUM (*Whitelegge*).

= *Lobophytum densum*, Whitelegge.

See Th. Whitelegge, "The Alcyonaria of Funafuti," Mem. Australian Mus. 1897, p. 219, pl. xi. figs. 4*a*–4*h*.

See E. M. Pratt, 1903, *loc. cit.* p. 521, pl. xxix. fig. 18, pl. xxx. figs. 20–22.

This species is represented by two very hard and brittle colonies. The trunk of one colony is 7.5 cm. broad and 5.8 cm. high. It passes almost imperceptibly into numerous finger-like processes. What we have observed in these specimens corresponds closely with Miss Pratt's figures (*Alcyonaria* of the Maldives, 1903).

Whitelegge (1897) has classified the spicules very minutely, and his subdivisions have been followed in taking the following measurements of length and breadth in millimetres:—

- i. Large fusiform, with simple spine-like tubercles and usually with a transverse median constriction : 2.5×0.5 ; 2.1×0.4 ; 2×0.4 .
- ii. Large fusiform, subcylindrical or subclavate, closely tuberculate, the tubercles being thickly studded with minute spiny warts : 3.1×0.5 ; 2.7×0.5 ; 2.3×0.45 ; 1.9×0.4 .
- iii. Smaller fusiform, strongly but distantly tuberculate : 0.75×0.25 ; 0.6×0.2 .
- iv. Small fusiform, comparatively smooth, but with some spines : 1×0.18 ; 0.48×0.1 .
- v. Spindles : 0.22×0.04 ; 0.19×0.04 ; 0.17×0.03 ; 0.06×0.03 .
- vi. Clubs : 0.12×0.04 ; 0.08×0.04 .

The colour of the colony in spirit is pale yellow : when living it was bluish-grey.

Locality.—Forms great sheets in about four feet of water in Suakin Archipelago (Tella Tella Seghir Island). Previously recorded from Funafuti, China Seas, British New Guinea, the Maldives.

LITHOPHYTUM ARBOREUM, *Forskål*.

For descriptions, see W. May (1899), *loc. cit.* p. 134, and W. Kükenthal, "Versuch einer Revision der Alcyonarien. II. Die Nephthyiden, 1 Teil," Zool. Jahrb. 1903, p. 124.

A large number of specimens are referable to this species. There is considerable variety as regards the dimensions of the spicules, and some forms approach *L. stuhlmanni*.

One of the largest specimens consists of a common basis 7 cm. in breadth, from which six branches take origin. These bear secondary branches on

which the polyps are thickly clustered in catkins. A typical branch separated from the common basis corresponds closely to the figure given by Klunzinger (1877).

In more than one specimen we found no trace of spicules, but as these specimens were badly preserved we suppose that some acid had been accidentally added to the preservative.

Localities.—Suez; Coral shoal of Kal el Kebira in Suez Bay; Khor Abu Hamama, 10 fathoms, muddy bottom. Previously recorded from Red Sea, Zanzibar, New Britain.

LITHOPHYTUM BRASSICUM (*May*). (Plate 5. fig. 4.)

See W. May, 1899, *loc. cit.* p. 139, fig. 22. W. Kükenthal, 1903, p. 120.

We have figured (Pl. 5. fig. 4) a specimen which agrees in essential features with *Lithophytum brassicum*, though it is somewhat divergent in its mode of growth and general appearance. It is fixed to a piece of Millepore and rises to a height of 20 mm., with a maximum breadth of 55 mm. It shows about sixty subglobose heads, each bearing about a score of polyps which are deeply retracted. The colour is a dull light brown.

Locality.—Edge of leeward reef, Suakim Archipelago, Tella Tella Kebira. Previously recorded from Zanzibar.

LITHOPHYTUM THYRSOIDES (*Ehrenberg*).

= *Ammothea thyrsoides*, Ehrenberg. See W. Kükenthal, 1903, *loc. cit.* p. 109.

Several fine specimens of this common species are included in the collection. They consist of a common basis from which cylindrical stalks rise parallel to one another. The polyps arise directly from the ends of the stalks. The spicules of the stalks and polyps are very slender transparent spindles with few warts.

The following measurements were taken of length and breadth in millimetres:—

- (a) Polyp-spicules: 0.3×0.01 ; 0.28×0.01 ; 0.2×0.01 ; 0.15×0.01 ; 0.12×0.01 ; 0.1×0.1 ; 0.05×0.01 .
- (b) Stem-spicules: 0.46×0.02 ; 0.37×0.02 ; 0.35×0.02 ; 0.27×0.02 ; 0.2×0.01 .

The colour of the preserved specimens is yellowish-brown; in life they were dull brown.

Locality.—Outer Park of Suakim Harbour. Previously recorded from Red Sea, Indian Ocean (Tumbatu), Zanzibar.

LITHOPHYTUM CROSSLANDI, n. sp.

A common stem, 2 cm. broad and 1.5 cm. high, gives origin to four limp branches showing longitudinal furrows. These branches are 13, 12, 9, and 7 cm. in length respectively, and carry secondary branches on which the

polyp-bearing twigs are clustered. The polyp-bearing twigs are in the form of catkins with a length of from 0.5 to 1.5 cm. The basal catkins are stouter and more closely beset with polyps than the upper.

A notable diagnostic feature is the presence of rows of closely aggregated small granular spicules in the tentacles, and continued on to the polyp-head and polyp-stalk.

More spicules are to be found in the cortex of the stem than in the cortex of the main branches; consequently the stem is somewhat more rigid. The spicules of the cortex include spindles with large spines; the spindles are sometimes curved, and the spines are in some cases longer on the convex surface; there are also spindles with few warts, irregular spinose bodies and bicuspid, *i. e.* with two prongs or cusps.

The following measurements were taken of length and breadth in millimetres :—

Spinose spindles : 0.72×0.2 ; 0.55×0.13 ; 0.52×0.1 ; 0.45×0.1 ;
 0.37×0.12 ; 0.33×0.15 ; 0.29×0.12 .

Spindles with few warts : 0.42×0.05 ; 0.375×0.1 ; 0.37×0.1 ; $0.35 \times$
 0.075 ; 0.35×0.1 ; 0.29×0.03 ; 0.25×0.1 ; 0.23×0.05 .

Bicuspid : 0.47×0.275 .

The canal walls contain highly spinose spindles, spindles with small warts, highly spinose club-shaped bodies, irregular spinose bodies, and bicuspid.

The following measurements were taken of length and breadth in millimetres :—

Highly spinose spindles (the spines being larger on the convex side) :
 0.52×0.12 ; 0.4×0.075 ; 0.37×0.11 ; 0.35×0.1 ; 0.3×0.1 ;
 0.3×0.15 .

Spindles with small warts : 1.02×0.22 ; 0.95×0.2 ; 0.85×0.175 ;
 0.52×0.12 ; 0.32×0.1 .

Highly spinose club-shaped bodies : 0.32×0.15 ; 0.275×0.175 .

Bicuspid : 0.42×0.175 .

Mr. Crossland notes that the specimen appeared whitish under water, pale brown when brought up.

Locality.—From a depth of three or four feet in the Coral-reef of Khor Delaweh.

LITHOPHYTUM MACROSPICULATUM, n. sp. (Plate 8. figs. 2 & 3.)

From a stem rather less than 1 cm. high, with a breadth of 2.5 cm. three primary branches take origin. One of these, after a course of half a centimetre, divides dichotomously into two branches of 4 and 5 cm. in length respectively. The other primary branches are 6 and 4 cm. in length.

Polyps are not borne either on the main stem or on the main branches, but

on secondary branches and the twigs which spring from these. The secondary branches are crowded closely on the primary and form catkins 1.5 to 2.5 cm. in length, the larger catkins being of a compound character.

In the cortex of the terminal polyp-bearing branches there is a longitudinal arrangement of the spindle-shaped spicules, and this is continued on to the dorsal surface of each polyp-stalk.

The polyp-heads are bent sharply on the polyp-stalks, so that the tentacular surface faces the cortex of the terminal twigs.

The cortical spicules of the stem and main branches form by interlacing a continuous armature. These spicules are of very diverse and distinctive forms, including the following :—

- (a) Boat-shaped spindles with few warts.
- (b) Curved spindles with long spines, which are more developed on the convex surface.
- (c) Very spinose club-like forms.
- (d) Triradial spinose bodies.
- (e) Irregular spinose bodies.

The following measurements were taken of length and breadth in millimetres :—

- (a) Boat-shaped spindles : 0.8×0.15 ; 0.75×0.075 ; 0.67×0.1 ; 0.62×0.1 ; 0.5×0.075 ; 0.45×0.09 .
- (b) Curved spindles : 0.95×0.15 ; 0.85×0.12 ; 0.8×0.15 ; 0.73×0.15 ; 0.7×0.1 ; 0.65×0.15 ; 0.52×0.13 ; 0.5×0.1 .
- (c) Club-like forms : 0.33×0.25 .

The spicules of the polyp-head and polyp-stalk include long curved or sinuous spindles with knob-like warts which in some cases are more numerous and better developed at the tips of the spindles ; also spindles with only a few poorly developed spines.

The following measurements were taken of length and breadth in millimetres :—

- (1) Spinose spindles : 1.5×0.1 ; 1.15×0.1 ; 1.1×0.12 ; 0.6×0.05 ; 0.4×0.05 ; 0.2×0.02 .
- (2) Smooth spindles with only a few spines : 1.2×0.09 ; 0.9×0.05 ; 0.69×0.05 .

The spicules of the canal walls consist of spindles similar to those of the cortex, but the form with few spines predominates.

The following measurements were taken of length and breadth in millimetres :—

- (1) Spinose spindles : 0.87×0.12 ; 0.85×0.12 ; 0.83×0.12 ; 0.6×0.1 ; 0.55×0.13 ; 0.5×0.1 .

- (2) Smooth spindles with only a few spines: 1.02×0.15 ; 0.72×0.15 ;
 0.6×0.075 ; 0.55×0.075 ; 0.42×0.1 ; 0.4×0.05 ; 0.275×0.04 ;
 0.2×0.05 .

The colour of the colony in spirit is light yellow.

Locality.—Khor Dongola.

NEPHTHYA ZANZIBARENSIS, Thomson and Henderson.

See Thomson and Henderson, 1906, *loc. cit.* p. 421, pl. xxvii. fig. 3.

A specimen which seems to be referable to this species differs from the type in being distinctly more rigid; that is to say, more densely filled with spicules.

Locality.—Engineer Island, Khor Dongola. Previously recorded from Wasin Channel, Zanzibar.

NEPHTHYA ALBIDA (Holm).

= *Spongodes albida*, Holm.

See O. Holm: "Beiträge zur Kenntniss der Alcyoniden-Gattung *Spongodes*," Zool. Jahrb. viii. (1895) p. 30, 3 figs.

See Kükenthal, 1903, *loc. cit.* p. 160.

A specimen which seems referable to this species differs from the type in having the polyp-body covered with very numerous small spicules without definite arrangement in double rows. In other words, the larger polyp-spicules arranged in chevron are not represented. In including *Nephtya jagerskioldi* with *Spongodes savignyi*, Kükenthal notes the same kind of variation which we believe to have occurred here, namely a replacement of fewer larger spicules on the part of the polyp-wall by more numerous smaller spicules. This cannot be regarded as of systematic importance.

Locality.—Suakim Harbour. Previously recorded from the Red Sea.

SPONGODES * *HEMPRICHI*, Klunzinger.

See Klunzinger, 1877, *loc. cit.*

Kükenthal, 1904, *loc. cit.*

Kükenthal: "Versuch einer Revision der Alcyonarien. II. Die Familie der Nephtyiden, 2 Teil," Zool. Jahrb. xxxi. (1905) pp. 503-726, 7 pls. & 61 figs.

Several colonies in the collection are evidently referable to a group of species which Kükenthal speaks of as closely allied, namely, *S. hartmeyer*, *S. mayi*, *S. klunzingeri*, *S. ehrenbergi*, and *S. hemprichi*.

* According to Kükenthal, the generic name *Spongodes* should be replaced by another and he suggests *Dendronephthya*; see page 74.

I. The specimens differ superficially from *S. hartmeyeri* :

- (1) in being much more ramified and crowded colonies ;
- (2) in the absence of any trace of foliate lower branches ;
- (3) in their colour-scheme, which is due to the thick covering of crimson spicules. As to the colour of the living specimen. Mr. Crossland notes that it appeared jet-black when seen through a fathom or two of clear water, but when brought up it showed a splendid dark crimson, shading into pink on the stem.

They differ more intimately in the following points :

- (1) The anthocodial spicules are arranged in 8 rows of 5-7 converging pairs ; they converge but slightly and are more or less longitudinal in *S. hartmeyeri*. Moreover, the uppermost spicules of the double rows do not project beyond the anthocodia as they do in *S. hartmeyeri*.
- (2) The tip of the main "Stützbündel" spicule is smooth, while in *S. hartmeyeri* the same spicule is most spinose towards the free tip.
- (3) They differ in the dimensions and direction of the spicules in the cortex of the main branches. In *S. hartmeyeri* the cortex is densely filled with large, very thick, finely spinose spindles up to 5×0.5 mm. They seem from the drawing to be longitudinally arranged. In the specimens in this collection the spindles are for the most part arranged transversely to the long axis of the branches.

The following measurements of these spindles were taken in length and breadth in millimetres : 2×0.12 ; 1.8×0.1 ; 0.65×0.05 .

II. The specimens differ superficially from *S. mayi* :

- (1) in the absence of the rigidity and brittleness characteristic of a species developed in one plane. The colonies in this collection have a well-developed bare trunk up to 7.5 cm. in length. In one specimen the stem divides somewhat dichotomously into two main divisions ; in another specimen, four main branches take origin abruptly. From the main branches secondary branches arise in every plane.
- (2) The branching is more profuse and the clusters of polyps are much denser than in *S. mayi*.
- (3) The colour-scheme is golden yellow in *S. mayi*.

They differ more intimately from *S. mayi* :

- (1) in the absence of a greatly developed projecting spicule at the end of each double row of spicules on the anthocodia ;

- (2) in the fact that only one "Stützbündel" spicule projects beyond the polyp-head; the tip of the "Stützbündel" spicules is *smooth*, like that of the chief "Stützbündel" spicules in *S. mayi* ;
- (3) in the disposition of the superficial cortical spicules, which are predominantly longitudinal in *S. mayi* ; and
- (4) in the character of the spicules of the cortex, which are curved spindles, while in *S. mayi* there are, in addition to spindles, clubs, four-rayed spicules, and irregular bodies.

III. The specimens differ superficially from *S. klunzingeri* :

- (1) since that species is for the most part developed in one plane with an almost suppressed trunk ;
- (2) in the mode of branching and in the disposition of the polyps in crowded bundles of 6-11 in each bundle, whereas in *S. klunzingeri* they are only 1-3 in a bundle.

They differ more intimately :

- (1) in the nature and arrangement of the anthocodial spicules, which in *S. klunzingeri* are in rows of 8-10 with the uppermost two very much longer ;
- (2) in having an entirely different "Stützbündel" made usually of two spicules ; and
- (3) inasmuch as the spicules of the canal-walls are broad and flat spinose spindles.

In the specimens the spicules of the canal-walls are varied and may be grouped as follows :

- (A) spindles of undulating contour, or halfmoon-shaped, or tending to be club-shaped ;
- (B) spindles forked at one end (bicuspid), transitional to triradiates ;
- (C) triradiate forms ;
- (D) irregular bodies with four arms, probably derived from C. All spinose.

IV. The colonies have a great superficial resemblance to *S. ehrenbergi*, but differ from it in having 6-11 polyps in each bundle, while *S. ehrenbergi* has 5-8.

They differ more intimately :

- (1) inasmuch as *S. ehrenbergi* has only 4-5 pairs of spicules in each double row, each about 0.3 mm. in length, the uppermost 0.5 mm. with long oblique spines ;
- (2) in the nature of the projecting spicules of the "Stützbündel," which in *S. ehrenbergi* has a spinose tip, whereas in these specimens the tip is smooth ;

- (3) in the spicules of the cortex of the main branches, which do not include any clubs or oval spinose bodies ;
- (4) inasmuch as from the canal-walls of *S. ehrenbergi* only spindles are reported.

V. The specimens agree with *S. hemprichi* in the following respects :

- (1) There are 5-7 pairs of anthocodial spicules in each double row and the uppermost pair project very slightly. It is to be noted, however, that the number of paired spicules on the two rows on the *ventral* surface of the polyp-head may be as few as two pairs.
- (2) The projecting spicule of the "Stützbündel" has a smooth tip.
- (3) The spicules of the canal-walls are, on the whole, similar. In *S. hemprichi* there are curved spindles, triradiates, and small bodies beset with several prongs.
- (4) The spicules of the cortex are arranged transversely.
- (5) The polyp-spicules are blood-red and the polyps yellowish.

The only difference between Crossland's specimens and those described by Kükenthal lies in the general architecture, which is well represented by Kükenthal's drawing of *S. ehrenbergi*. They may be referred to the *arborescens* type of *S. hemprichi*, which Kükenthal describes as transitional between the glomerate and the divaricate mode of branching.

Another specimen which is superficially very unlike the above, but closely resembles Klünzinger's figure of *Spongodes hemprichi*, is in its details so like what we have described that we cannot but refer it to the same species, which, therefore, includes two distinct modes of growth—that figured by Klünzinger and the *arborescens* type of Kükenthal.

A case like this leads us to feel the precariousness of a classification which attaches much importance to modes of branching.

Locality.—Shab Baya, near Rawayā. Previously recorded from Red Sea.

SPONGODES HARTMEYERI, Kükenthal.

Two small rigid whitish colonies seem to be referable to this species, but differ in having no coloured spicules and in having rougher "Stützbündel" spicules. They are probably young colourless forms.

Locality.—Khor Dongola. Previously recorded from the Red Sea.

SPONGODES SUESIANA, n. sp. (Plate 5. fig. 1.)

A brownish-yellow interesting colony of apparently glomerate type. It resembles in general architecture Kükenthal's *Spongodes* (*Dendronephthya*) *clavata* (see Versuch einer Revision der Alcyonaceen. Die Nephthyiden, 2^{te} Teil,

Taf. 26) ; but in the nature of the projecting "Stützbündel" spindle and in the number and arrangement of the spicules on the anthocodia it closely approaches *S. mayi*. It seems to belong to the group of allied species referred to under *S. hemprichi*.

There is a somewhat flattened flexible stem, longitudinally furrowed, 8.5 cm. in length and 1 cm. in breadth. The cortex of the stem shows well-marked transverse striations due to the underlying spindles.

Small polyp-bearing twigs spring from the stem, somewhat sparsely below, more thickly above, so that the apex of the stem is completely hidden by polyp-bundles.

From the stem there arise at irregular intervals secondary branches whose length decreases in a somewhat graduated fashion. The following measurements of the length of the various branches from below upwards on the stem serve to indicate this feature : 2 cm. ; 1.75 cm. ; 1.5 cm. ; 1 cm. These secondary branches bear polyp-bearing twigs in thick clusters. The polyps are in bundles of from 6 to 12 or even more.

The "Stützbündel" consists of 2 to 4 spindles, one of which projects 0.4 mm. or more beyond the anthocodia. This spindle is spinose below with a smooth tip. Of the projecting "Stützbündel" spicules, which are generally of a yellow colour, the following measurements were taken (length and breadth in millimetres) :— 2.3×0.1 ; 2.4×0.1 . The tip is smooth for 0.35 mm.

On the anthocodia there are eight double rows of converging spicules with from 6 to 9 in each row. One spicule of the uppermost row, or occasionally both, may project for 0.2 mm. beyond the anthocodia. Thus Kükenthal's figure of an anthocodia of *S. mayi* (see Ueber einige Korallentiere des roten Meeres, Taf. v. fig. 20) exactly represents what may be seen occasionally in this species, except that only one projecting "Stützbündel" spicule is the rule and not two as figured.

When both spicules of the uppermost row project, they lie almost parallel to each other in sharp contrast to the pairs below, which converge at a right or a slightly obtuse angle.

The tentacles are without spicules. The colour of the anthocodial spicules ranges from red to yellow.

The spicules of the upper cortex consist of spindles, clubs, bicuspid, with an occasional triradiate form. They are very spinose, not merely along the margins, but on every surface; and are colourless or tinged with yellow.

The following measurements were taken of length and breadth in millimetres :—

Spindles : 1.7×0.1 ; 1.4×0.1 ; 0.95×0.075 ; 0.8×0.05 ; 0.75×0.075 ; 0.7×0.075 ; 0.6×0.05 ; 0.5×0.05 ; 0.25×0.02 .

Clubs : 0.75×0.1 ; 0.4×0.1 .

Bicuspid : 0.6×0.075 .

Triradiates: each arm, 0.3×0.2 .

The spicules of the lower cortex do not differ from those of the upper cortex in form or colour.

The following measurements were taken of length and breadth in millimetres :—

Spindles : 0.75×0.075 ; 0.7×0.1 ; 0.65×0.05 ; 0.6×0.05 ; 0.5×0.03 ;
 0.4×0.05 ; 0.3×0.03 ; 0.1×0.03 .

Clubs : 0.6×0.1 ; 0.4×0.1 ; 0.3×0.1 ; 0.35×0.075 ; 0.3×0.075 .

The canal-walls are without spicules.

Some other specimens agreed with the above in general structure, in the nature of the "Stützbündel," in the armature of the anthocodia, in the spicules of the cortex, and so on. Thus one could not but admit that all the colonies belonged to the same species, and yet it was impossible to say that the polyps were really grouped in bundles, which is one of the diagnostic features of the genus *Spongodes*. In some cases they were arranged on a terminal branch in a catkin-like or spike-like manner. This was the rule in one specimen.

It may be noted that Kükenthal admits that certain specimens were intermediate in this respect between *Spongodes* and *Nephthya*, and consequently difficult to place.

The point to be noted in these colonies is that, though obviously all of the same species, yet they differ in a generic feature !

If we take a composite view of all the specimens this species combines the characteristics of both *Spongodes* and *Nephthya*. Yet the colony described in detail must be placed in the glomerate division of the genus *Spongodes*. Within that division it seems to represent a new species.

Locality.—Suez Bay.

SPONGODES PHARONIS, n. sp. (Plate 5. figs. 2 & 3.)

Several colonies of the umbellate type, agreeing with Kükenthal's *rubra*-group in having branches of approximately equal length, with the upper surface practically even. They differ from any of the species of *Spongodes* hitherto described from the Red Sea—viz. : *S. savignyi*, *S. hemprichi*, *S. klunzingeri*, *S. arborea*, *S. mayi*, *S. hartmeyer*, and *S. ehrenbergi*—in possessing the following combination of diagnostic characters :—

- a. The umbellate development of the colony.
- b. The absence of spicules on the tentacles.
- c. The absence of spicules in the canal-walls.
- d. The occasional presence of a strongly developed spine or sometimes of two spines projecting prominently beyond a corymb of polyps, greatly exceeding in diameter and in length the "Stützbündel" spicule or spicules which project beyond the anthocodia of each polyp.

The colonies show in each case a substantial trunk which at a distance of 2·5 cm. or less from its base is embraced by a collar of foliate lower branches. These leaf-like branches bear sessile polyps scattered round their margin, while further on the upper surface may be seen twigs, which divide in the corymbose fashion characteristic of the whole colony. These twigs also carry polyps on their tips.

From the angle between the rising stem and the collar spring one or two branches equal in size to those that are terminal. These branches in their turn break up into terminal corymbs. Beyond the collar, the stem after a short course divides into two or three main branches, which soon divide up into secondary branches supporting the terminal corymbs. The terminal corymbs are all brought more or less to the same level, so that the upper surface of the polyparium is somewhat flattened. A polyp-bundle usually comprises 3 to 8 individual polyps, but the number is very variable.

The polyp-head is bent more or less at a right or an acute angle to the polyp-stalk. The polyp-head is 0·8 mm. in length and 0·55 mm. in breadth. The polyp-stalk is about 1 mm. in length. The anthocodial spicules are in rows of 3 to 5 pairs, the uppermost of which do not project beyond the anthocodia.

The angle of each chevron is a very acute one, giving a somewhat longitudinal direction to the spicules of the anthocodia.

Some variation in colour is to be noted in the anthocodial spicules. In one of the colonies they are colourless, in another red, while transitional pinkish spicules are present in a third colony. In the "Stützbündel" there may be one or two projecting spicules. These spicules show very small serrations regularly disposed. Their tip may be quite smooth or with an occasional serration. Their colour varies from a light yellow to a reddish yellow.

The following measurements were taken of these spicules (length and breadth in millimetres):— $1·5 \times 0·03$; $1·25 \times 0·1$; $0·8 \times 0·03$; $0·7 \times 0·03$. In some of the colonies the size of the projecting "Stützbündel" spicules approaches nearer to the dimensions of the stout spines which are a feature of the terminal corymbs. These strong spine, which seem to protect and support the polyps on a terminal corymb, generally arise independently of an individual polyp, but sometimes they simply take the place of the normal but smaller "Stützbündel" spicule.

Of these stouter spindles the following measurements were taken (length and breadth in millimetres):— $4 \times 0·25$; $4 \times 0·2$; $3·5 \times 0·15$; $3·5 \times 0·125$. The tentacles are oblong with a few pinnules and without spicules.

The cortex of the upper branches contains slightly curved spindles with very fine and regularly disposed serrations.

The following measurements of these spindles were taken (length and breadth in millimetres):— $4 \times 0·2$; $3·2 \times 0·1$; $1·4 \times 0·5$; $1 \times 0·03$. Their colour in one specimen is white with a yellowish tinge, in three specimens

red, but amongst the red spindles are some with intermediate light-pink shades.

Their distinctive feature lies in the remarkably fine serration of the edges of the spindles. This is a constant feature no matter what their dimensions or colour may be.

The lower cortex contains markedly spinose irregular bodies, often somewhat star-shaped, very spinose spindles, spinose clubs, spinose triradiates, spinose bicuspidis.

The following measurements were taken of length and breadth in millimetres :—

Spinose spindles : 1×0.1 ; 0.75×0.1 ; 0.4×0.12 ; 0.33×0.1 ; 0.3×0.11 ;
 0.25×0.1 ; 0.23×0.075 .

Spinose triradiates : 0.5 ; 0.33 ; 0.3 = length of the three arms.

Spinose bicuspidis : 0.75×0.1 .

Spinose clubs : 0.18×0.13 .

The canal-walls in every specimen are without spicules.

The colour of the colonies in spirit varies somewhat, the colour depending on that of the spicules. Where the spicules are red, the colony is reddish ; where there are a considerable number of white or light yellow spicules, the colony is proportionately lighter in tint.

Locality.—From a muddy bottom, at a depth of 12 fathoms, Mersa Abu Hamama, Sudan.

Order III. PSEUDAXONIA, G. von Koch.

MELITODES COCCINEA (*Ellis*) (= *Isis coccinea*, *Ellis*). (Plate 6. figs. 1 & 2.)

The collection includes numerous specimens which are referable to *Ellis's Isis coccinea*. From *Ellis's* figure and description there can be almost no doubt that he referred to forms like the present specimens, which must, however, be referred to the genus *Melitodes*.

The specimens are of a brilliant crimson or scarlet colour, and there is one yellow fragment. The most frequent mode of branching is that figured by *Ellis*,—a broad fan, with dichotomous branches almost all in one plane, and without anastomosis. In other specimens, however, the branches do not spread out in a broad fan, and anastomosis is frequent. The colonies stand erect, reaching a height of 4 cm. and a breadth of 2–4 cm. In some cases colonies grew so close to one another that their bases formed a continuous sheet. Solitary colonies show most clearly the typical fan-like form.

The internodes, which curve slightly in different planes, vary in length from 5–10 mm. The nodes are very short, 1–2 mm., and are not distinctly marked in the intact colonies. On the thinner twigs the verrucæ are mostly along the edges, and a somewhat flattened appearance thus results. On the

thicker branches they occur practically all over. They stand out somewhat prominently to a height of about 0.5 mm., and appear as widely open crater-like elevations or as rounded hillocks according to the state of contraction.

The whole surface of the colony is seen under the lens to be rough with spindle-shaped spicules, all of a red colour.

The spicules of the coenenchyma are: (1) substantial tuberculate spindles, of which the following measurements were taken:— 0.3×0.07 , 0.27×0.09 mm. The tubercles are large and blunt. In some cases the ends of the spindles are irregularly bifid. There are also some slender curved tuberculate spindles. (2) Short compact fusiform types covered with numerous blunt tubercles: 0.124×0.05 mm. (3) Club-shaped forms or "Stachelkeulen" with irregularly shaped tuberculate heads. From these through torch-like forms there are transitions to irregular spindles. The clubs are frequently 0.23 mm. in length by 0.1 mm. in breadth across the head. In the polyps there are minute and slender red spindles, besides a number of minute slightly tuberculate curved rodlets which are practically colourless. For both of these types a common length is 0.04 mm. The aboral surface of the tentacles bears about 5 large red spicules arranged in chevron. The axis shows longitudinal canals.

Locality.—From the sides of a buoy in Suez Bay, and on the coral-reef of Engineer Island, Khor Dongola.

MELITODES SPLENDENS, n. sp. (Plate 7, figs. 1 & 2.)

Numerous broken pieces of a bright orange-red Melitodid. They seem to represent several colonies. The nature of the spicules and the presence of longitudinal canals in the axis indicate the genus *Melitodes*, but we have not been able to refer the specimens to any of the numerous previously described species.

One of the pieces has a breadth of 6 mm. across an internode about 3 cm. above the base, while a node about the same height has a breadth of 9 mm. The length of the internode at this level is 11 mm., and towards the base the colony the internodes have an average length of about 12 mm. The branching is profuse, with many anastomoses, but is mainly confined to one plane. An attempted reconstruction of the broken specimens leads one to infer that the colonies may have been about 25 cm. in height. The terminal branches are about 1 mm. in thickness.

The verrucae are almost confined to one surface of the branches. They are somewhat scattered on the basal parts, but towards the ends their bases are in contact. They are slightly flattened hemispheres. The retracted polyp is just seen as a whitish spot on the top of the verruca.

The axis shows numerous longitudinal canals in the nodes and internodes. A thin section through a thick internode showed about ten. On the surface of the axis there is external fluting corresponding to the course of the canals in the coenenchyma.

The spicules, which are mostly yellowish, include : —

- (a) Narrow tuberculate spindles of various sizes, *e.g.* 0.15×0.018 mm., 0.108×0.03 mm.
- (b) Short broad spindles with tubercles at each end and in two whorls between, *e.g.* 0.04×0.025 mm.
- (c) Fusiform types intermediate between (a) and (b) with sharper tubercles.
- (d) A few non-foliate clubs, *e.g.* 0.055×0.028 mm. across the head.
- (e) Some pale yellow or almost colourless rods, sometimes almost straight and smooth, often with a median prominence on each side, often slightly curved at the ends, *e.g.* 0.096×0.012 mm.

The generic distinctions of the Melitodidæ are not very satisfactory, but we may note that the absence of foliaceous clubs, the presence of some small nodular spicules in the cortex, and the canals in the axis point to *Melitodes*.

Locality.—Mersa Abu Hamama, from a muddy bottom, at a depth of 10 fathoms.

* *CLATHRARIA RUBRINODIS*, Gray. (Plate 6. figs. 3 & 4.)

See Gray: Proc. Zool. Soc. London, 1859, p. 486; Catalogue of Lithophytes in the British Museum, 1870, p. 11, 1 fig.

= *Mopsea bicolor*, Kölliker, Icones Histologicæ, p. 142, 1 fig.

It is interesting to find in this collection the peculiar Melitodids to which Gray gave the names *Clathraria rubrinodis* and *C. acuta*. It is rather remarkable that such striking forms have not been more frequently collected. Apart from Gray's brief descriptions, we have found no reference to *Clathraria*.

The larger species, *C. rubrinodis*, is represented by a specimen about 12 cm. in height, which was probably the upper part of a large colony. This is suggested by the size of some of the fragments found in the same vessel.

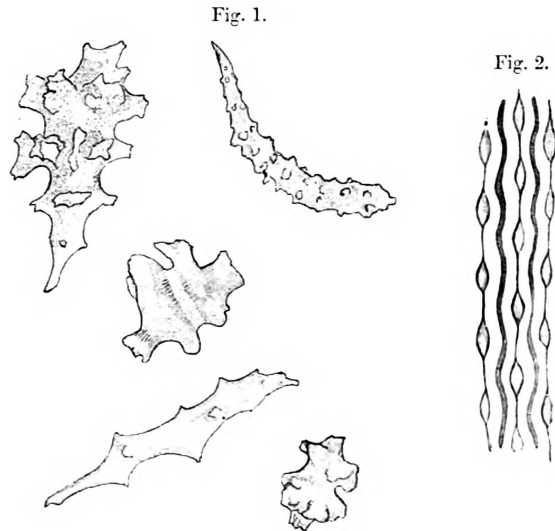
The branching is mainly in one plane, and there is abundant anastomosis. The branches arise almost invariably from the nodes. There is a strong tendency to dichotomy, and the two branches diverge at a wide angle at their common origin. This gives a very characteristic appearance, which is increased by the fact that each of the cylindrical branches is of uniform width throughout its length, and terminates bluntly, or may, indeed, be slightly thicker at the tip than at its origin. The smaller twigs show a much less marked tendency to dichotomy, and some of them narrow towards the

* The account of *Clathraria rubrinodis* and *C. acuta* was prepared by Miss Doris L. Mackinnon as part of a thesis for the degree of B.Sc. in the University of Aberdeen.

end, which is always truncate. The stouter branches have a diameter of 4 mm. ; the more slender twigs of 2 mm.

The preserved specimens have a dirty cream-colour, frequently tinged with pale sulphur-yellow along one side of a branch and near the tips of the twigs. In the living specimens the colour was bright light yellow, with dull red joints. The specific name *rubrinodis* has reference to the dark-red horny nodes, which shine indistinctly through the whitish cœnenchyma, or appear as bright red patches where a branch has been broken away.

The internodes are of very unequal lengths, varying from 7 to 32 mm. : the calcareous axis, stripped of cœnenchyma, has a diameter of 1-3 mm., and is white with a tinge of sulphur-yellow here and there. The longer branches may have as many as seven internodes ; the shorter branches and the twigs consist of only one piece.



Clathraria rubrinodis, Gray.

Fig. 1. Spicules. Fig. 2. Details of calcareous joints.

On the surface of the white calcareous axis there is a characteristic sculpturing due to longitudinal furrows. There are two sets of these furrows which alternate with one another. One set is deeper than the other and of equal width throughout. The shallower furrows are constricted at regular intervals, and the broad portions of one shallow furrow lie between the constrictions of the similar furrow on either side. In these broad ovals the polyps appear to be set.

There are no nutritive canals in the axis. A longitudinal section shows that the axis is built up of minute spindle-shaped spicules, fused together, and arranged with their long axes in the line of the long axis of the branch.

The nodes are much shorter than the internodes (3-4 mm.) and are somewhat thicker. They are composed of a dark-red horny substance, which, under the microscope, appears as a yellowish network with numerous red spindle-shaped spicules in the meshes.

It occasionally happens that a branch arises from an *internode*; in such cases the first joint is horny.

The cream-coloured cœnenchyma is crowded with small spicules. Most of these are white, but some are tinged with yellow or yellowish green. Spiny clubs and more warty double-clubs and dumb-bells are very abundant. Spindles bearing numerous very minute warts are less common, and simple spindles are rare.

The following measurements were taken of length and breadth in millimetres:—

Clubs : 0.136×0.084 ; 0.153×0.059 ; 0.119×0.051 .

Double clubs : 0.042×0.034 ; 0.067×0.055 ; 0.051×0.042 .

Spindles : 0.187×0.051 ; 0.119×0.025 .

Red spindles of nodes : 0.102×0.017 ; 0.085×0.017 ; 0.068×0.002 .

The small polyps are spirally arranged almost uniformly all round the branches. They are nearly all retracted, lying almost flush with the surface of the cœnenchyma. Besides the substantial anastomosis, there may be a more superficial fusion of cœnenchyma when one branch lies against another.

Locality.—Coral-reef, Mersa Makdah, Shubuk.

CLATHRARIA ACUTA, Gray. (Plate 7. figs. 3 & 4.)

See Gray : Catalogue of the Lithophytes in the British Museum, 1870, p. 12.

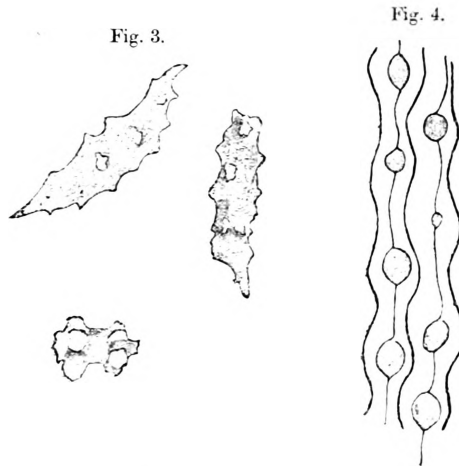
This species is represented by two specimens, one of 7 cm. and the other of 5 cm. in height. The mode of growth is tree-like and graceful. The branches, much more slender than in *C. rubrinodis*, are cylindrical and of very uniform width until close to their end, when they narrow abruptly into a sharp apex.

In the larger specimen there is a main stem, which gives off two long branches on one side, two long and three short on the other, and then bifurcates at the top. The side branches also show dichotomy. Of the seven branches four arise from the internodes. The other specimen is branched dichotomously throughout and the branches arise from the nodes. On the whole the branching is in one plane. There may be fusion of branches, but not nearly to the same extent as in *C. rubrinodis*.

The colour of the preserved specimens is a delicate flesh-pink, marked by

darker red patches where the nodes shine through the semi-transparent cœnenchyma. The living colonies were pink.

The calcareous internodes vary from 10 mm. to 17 mm. in length, and are about 2 mm. in diameter. They are marked longitudinally by sinuous furrows which expand at intervals into little round pits. The colour of the axis shades from deep rose-red to pink.



Clathraria acuta, Gray.

Fig. 3. Spicules. Fig. 4. Details and ornament on calcareous joints.

Microscopic examination shows that the axis is composed of numerous spindles fused together, with their long axes in line with the long axis of the branch. The nodes are dark red, much shorter than the internodes, and slightly swollen; they are composed of a yellowish horny network enclosing short red spindles.

The pinkish-white cœnenchyma is semi-transparent and very delicate. The polyps are not nearly so numerous as in *C. rubrinodis*, but are larger in proportion and project from the surface as minute warts. They seem to correspond in position to the cup-shaped pits in the axis of the internodes, and their arrangement is very markedly spiral.

The spicules of the cœnenchyma are spiny and tuberculate clubs and warty double-clubs with a few spindles and boomerangs. They are, on the whole, rather smaller than in *C. rubrinodis* and distinctly less spiny. The majority are colourless, but many show a red or pink tinge.

Locality.—Khor Dorgola, near the group of Islets; rock bottom, 9½ fathoms.

Note on the Genus Clathraria, Gray.

In 1859 Gray gave a brief description of his genus *Clathraria* as represented by *C. rubrinodis*. In 1870 he referred the genus to the family Mopselladæ and distinguished another species, *C. acuta*.

Gray's diagnosis of *Clathraria* is as follows:—"Coral shrub-like; branches cylindrical, erect, tortuous, interosculating, of nearly equal thickness; branchlets, some free, blunt. Bark thin, granular. Cells small, immersed, nearly equally scattered on all sides of the branches; buds and branches from the swollen joints; joints elongate, white, longitudinally striated; internodes red, spongy."

Gray identified his *C. rubrinodis* with Kölliker's *Mopsea bicolor* ('Icones Histologicæ,' p. 142). Kölliker defined his genus *Mopsea* thus:—"Axis without nutritive canals. Spicules generally as in *Melithæa*, but without the beautiful foliaceous clubs. Length of the clubs 0.12-0.25 mm.; length of the larger polyp-spindles 0.18-0.34 mm." Of *M. bicolor* he says:—"Soft joints red, hard joints white with green centre. Cœnenchyma white to sulphur-yellow, with uneven surface. Thickness of axis 4-7 mm."

In the 'Challenger' Report (1899) Wright and Studer separate *Clathraria* from *Mopsea*, and give the following definition:—"Cylindrical manifoldly curving branches often anastomosing, and of uniform thickness throughout. The polyps are sunk in the cœnenchyma. The axis includes no nutritive canals. Spicules in cortex, broad and short foliaceous clubs."

In subsequent literature we find no further mention of *Clathraria*, though it is a very conspicuous and characteristic type. It is so unlike other Melitodids that its retention as a distinct genus seems desirable.

The specimens from the Red Sea are clearly referable to *Clathraria* and to the species *C. rubrinodis* and *C. acuta*. We are thus able to give the habitats of these two forms, which Gray was unable to do. The note in the 'Challenger' Report that the spicules are "broad and short foliaceous clubs" must have crept in by some mistake.

The definitions which Gray gave of *Clathraria* and *Mopsea* hardly justified him in his wide separation of the two genera, which he referred to different families. He makes no mention of the form of the spicules, and he says that the branches arise in both from the soft joints.

Kölliker's *Mopsea* is separated from his *Melithæa* by having no foliaceous clubs. His definition of *Mopsea*, so far as it goes, would cover both *Mopsea* and *Clathraria*.

In the 'Challenger' Report the genus *Mopsea* is re-constructed, and if the definition there given be considered more satisfactory than Kölliker's, then it is necessary to continue to keep *Clathraria* apart from *Mopsea*. It is noted, for instance, as a characteristic of *Mopsea* that the branches arise mostly from the internodes, whereas in *Clathraria* they arise mostly from the nodes.

The spicules of *Mopsea* are described as "finely-spined, unsymmetrical scales, slightly notched at the edge; the spicules of *Clathraria* are spiny and tuberculate clubs, warty double-clubs, and spindles with very minute warts." For these and other reasons we think that *Clathraria* may be usefully retained as a distinct genus.

PROVISIONAL LIST OF RED SEA ALCYONARIANS.

Those included in Mr. Crossland's collection are marked with an asterisk. The names in *square* brackets indicate the authorities for occurrence in the Red Sea. In other cases the authority for the species is also the authority for its occurrence in the Red Sea.

Order I. **STOLONIFERA.**

- * *Clavularia pulchra*, Thomson & Henderson.
- Clavularia strumosa*, Ehrenberg.
- Clavularia glauca* (Savigny).
- * *Sympodium fulvum*, Forskål [Klunzinger] [Kükenthal] = (according to Kükenthal) *Aleyonium fulvum* (Forsk.).
- Sympodium carruleum*, Ehrenberg. [Klunzinger] [Kükenthal].
- Anthelia fuliginosa* (Ehrb.) [Kükenthal] = (according to Kükenthal):
 - Sympodium fuliginosum*, Ehrenberg [Klunzinger].
 - Sympodium purpurascens*, Ehrenberg [Klunzinger].
 - Anthelia glauca* (Ehrb.) [Klunzinger].
 - Anthelia strumosa* (Ehrb.) [Klunzinger].
- * *Tubipora purpurea*, Pallas [Klunzinger].
- Tubipora hemprichi*, Ehrenberg [Klunzinger].

Order II. **ALCYONACEA.**

- * *Xenia umbellata*, Savigny [Klunzinger] [Kükenthal].
- * *Xenia fuscescens*, Ehrenberg [Klunzinger] [Kükenthal].
- * *Xenia carulea*, Ehrenberg [Klunzinger].
- Xenia blumi*, Schenk [May].
- * *Aleyonium sphaerophorum*, Ehrenberg [Klunzinger].
- Aleyonium globuliferum*, Klunzinger.
- Aleyonium digitulatum*, Klunzinger.
- Aleyonium pachyclados*, Klunzinger.
- Aleyonium brachyclados*, Klunzinger.
- Aleyonium polydactylum*, Dana [Klunzinger].
- Aleyonium leptoclados* [Klunzinger].
- Aleyonium gyrosus*, Klunzinger.

- Alcyonium pauciflorum*, Ehrenberg.
Alcyonium polydactylum, Ehrenberg.
Alcyonium rubiformis, Ehrenberg.
Alcyonium aurum, Gray.
Alcyonium elegantissimum, May.
 **Sarcophytum glaucum*, Quoy & Gaimard.
Sarcophytum pulmo, Haeckel [Klunzinger].
Sarcophytum pauciflorum [Klunzinger].
Sarcophytum savignyi, Klunzinger.
Sarcophytum ehrenbergi, Marenzeller.
Sarcophytum trocheliophorum, Marenzeller.
 **Sclerophytum gardineri*, Pratt.
 **Sclerophytum querciforme*, Pratt.
 **Sclerophytum densum* (Whitelegge).
Lobophytum pauciflorum, Ehrenberg.
 **Nephthya zanzibarensis*, Thomson & Henderson.
 **Nephthya albida* (Holm).
Nephthya chabrolii, Milne-Edwards & Haime [Klunzinger].
 **Lithophytum thyrsoides*, (Kükenthal) = *Ammonothea thyrsoides*, Ehrenberg
 [Klunzinger].
 **Lithophytum arboreum*, Forskål [Klunzinger].
 **Lithophytum brassicum* (May).
 **Lithophytum crosslandi*, n. sp.
 **Lithophytum macrospiculatum*, n. sp.
 **Spongodes* † *hemprichi*, Klunzinger [Klunzinger] [Kükenthal].
 **Spongodes hartmeyeri*, Kükenthal [Kükenthal].
 **Spongodes suesiana*, n. sp.
 **Spongodes pharonis*, n. sp.
Spongodes savignyi, Ehrenberg (Klunzinger) [Kükenthal].
Spongodes ramulosa, Gray [Klunzinger].
Spongodes klunzingeri, Studer [Kükenthal].
Spongodes arborea, May [Kükenthal].
Spongodes mayi, Kükenthal.
Spongodes ehrenbergi, Kükenthal.

Order III. PSEUDAXONIA.

- **Melitodes coccinea* (Ellis) = *Isis coccinea*, Ellis.
 **Melitodes splendens*, n. sp.

† According to Prof. Kükenthal, who has revised this genus, the old name *Spongodes* should be changed to *Dendronephthya*. To us this appears neither necessary nor desirable.

- Mopsella erythræa*, Gray [Klunzinger = *Mopsea erythræa*].
 * *Clathraria rubrinodis*, Gray.
 * *Clathraria acuta*, Gray.
Siphonogorgia mirabilis, Klunzinger.

Order IV. **AXIFERA.**

- Caligorgia verticillata*.
Plexaura antipathes, Kölliker [Klunzinger].
Plexaura torta, Klunzinger.
Verrucella flexuosa (Lamarck) [Klunzinger].
Juncella gemmacea, Kölliker [Gray] [Klunzinger].
Juncella hepatica, Klunzinger.

EXPLANATION OF THE PLATES.

PLATE 5.

- Fig. 1. *Spongodes sueciana*, n. sp. Nat. size.
 2. *Spongodes pharonis*, n. sp. A small bundle of polyps. $\times 10$.
 3. *Spongodes pharonis*, n. sp. Nat. size.
 4. *Lithophytum brassicum* (Kükenthal). Nat. size.
 5. *Sarcophytum glaucum*, Quoy & Gaimard. Nat. size.

PLATE 6.

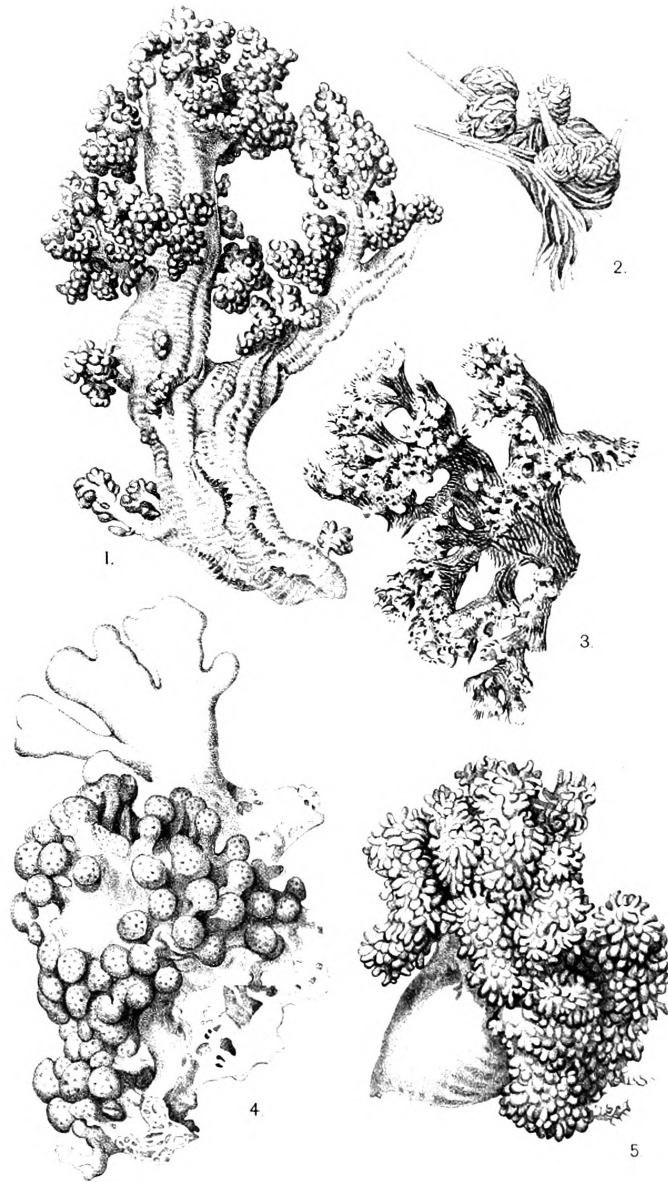
- Fig. 1. *Melitodes coccinea* (Ellis). $\times 12$.
 2. *Melitodes coccinea* (Ellis). Nat. size.
 3. *Clathraria rubrinodis*, Gray. $\times 7$.
 4. *Clathraria rubrinodis*, Gray. Nat. size.

PLATE 7.

- Fig. 1. *Melitodes splendens*, n. sp. $\times 12$.
 2. *Melitodes splendens*, n. sp. $\times 12$.
 3. *Clathraria acuta*, Gray. Nat. size.
 4. *Clathraria acuta*, Gray. $\times 7$.

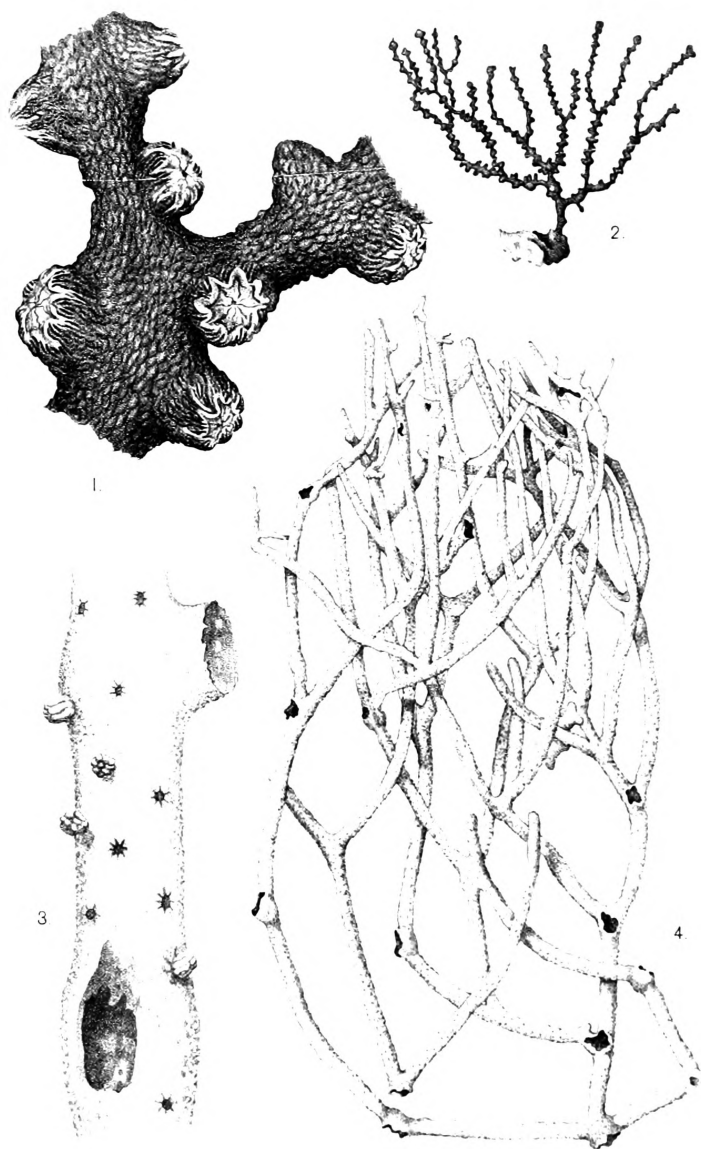
PLATE 8.

- Fig. 1. *Sclerophytum querciforme*, Pratt. Nat. size.
 2. *Lithophytum macrospiculatum*, n. sp. $\times 2$.
 3. *Lithophytum macrospiculatum*, n. sp. A cluster of polyps. $\times 14$.



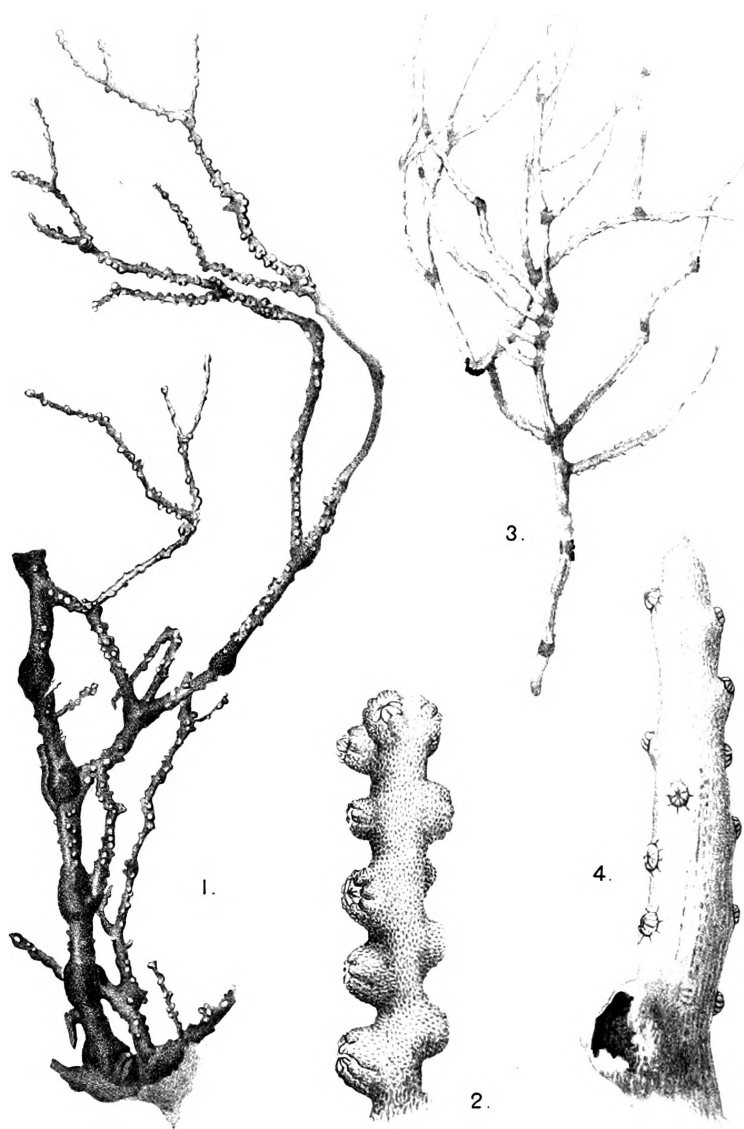
F. Wilson, lith. & imp.

SUDANESE ALCYONARIA.



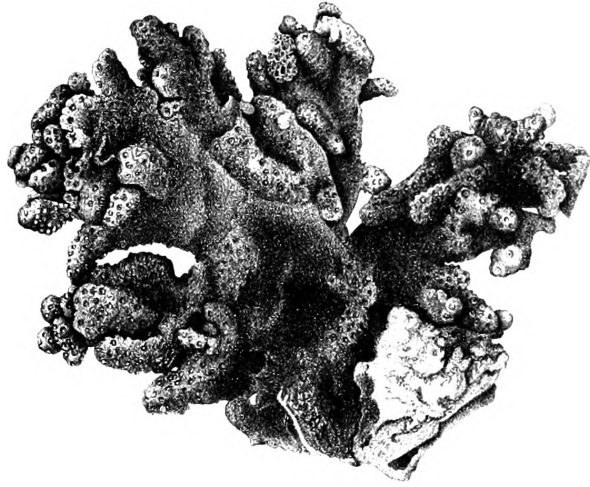
E. W. CROSBY

ACRONYCTA ALPHEMARTA

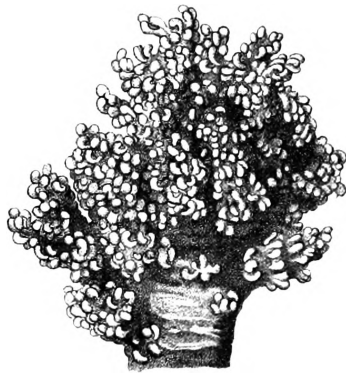


E. Wilson & H. A. M. P.

SULANESE ALCYONARIA



1.



2.



3.

SUDANESE ALCYONARIA.

(JOURN. R. MICR. SOC. 1908, pp. 675-81.)

XX.—*Note on a Remarkable Alcyonarian, Studeria* mirabilis*
g. et sp. n.

By PROFESSOR J. ARTHUR THOMSON, M.A.

(Read November 18, 1908.)

PLATE XVI.

A COLLECTION of Alcyonarians made by the 'Investigator' in the Indian Ocean included a specimen from the Andamans which is certainly one of the most remarkable of the many interesting representatives of this sub-class that have been discovered within recent years. It is a cup-like colony, with a large retractile polyparium. The cup is 45 mm. in height by 55 mm. in maximum diameter, and it is continued into a basal wisp (19 mm. in length), which, however, shows no attaching disk. The specimen gave indication of having been imbedded in the mud up to about the maximum diameter of the cup.

General Structure.—The most striking peculiarity of this Alcyonarian is that the whole of the polyp-bearing portion is retracted within the exceedingly substantial, densely spinose cup, the circular mouth of which is about 30 mm. in diameter, and shows the tips of numerous finger-like polyp-bearing lobes or branches. It seems quite likely that the mouth of the cup was capable of more complete closure, and, on the other hand, that the retracted polyparium was capable of considerable protrusion.

A longitudinal median section of the single specimen shows a dome-shaped fleshy centre, or thalamus, from the margins and summit of which most of the numerous finger-like polyp-bearing lobes arise. Some of them, however, are attached to the inner wall of the cup at different levels. The central dome, it should be noted, rises quite freely in the middle of the cup; its diameter is greater than half the maximum diameter of the cup. The arrangement of the polyp-bearing lobes may be compared to the distribution of carpels and stamens in the flower of some of the Rosaceæ, in which the former are disposed on a dome-shaped central thalamus, and the latter on several whorls on the inner wall of the "calyx-tube." Or, again, the central region of our specimen may be com-

* I have named this type in honour of Professor Th. Studer, of Bern, who has contributed so largely to our knowledge of Alcyonaria.

pared to the disk of a Composite's capitulum and the peripheral parts to the ray-florets (plate XVI, fig. 1).

There are large longitudinal canals in the central dome, separated by tough hyaline mesogloea. Very strong muscle-bands pass down their walls, and there are others in the wall of the cup reaching almost to the margin. These longitudinal bands pass for a short distance into the wisp-like stalk and gradually disappear. Numerous well-defined transverse muscles extend between the several longitudinal bands.

The Cup.—The cortical part of the wall of the cup, which is very definite and has a thickness of about 2 mm., is extremely hard, consisting mainly of long spindles, readily visible to the naked eye (some over 5 mm. in length), arranged for the most part in longitudinal interlacing rows. On the surface many of the spindles lie exposed throughout their whole length. Towards the base of the cup the spicules increase in size, and they attain their maximum dimensions—almost 1 cm. in length—in the basal wisp. These are probably the largest Alcyonarian spicules as yet known.

The internal part of the wall of the cup, as distinguished from the hard cortex just described, is soft and muscular. It is about 9 mm. in thickness where it joins the base of the dome, and narrows gradually to the margin of the cup.

The System of Canals.—Each of the finger-like polyp-bearing lobes has a large canal, with which the cavities of the polyps communicate. These branch canals pass into the dome or the wall of the cup, as the case may be, and uniting with others form the main longitudinal canals. These are relatively large, especially at the base of the cup and below the central dome, where they are about 2.5 mm. in diameter. From this region of maximum size, they gradually taper into the wisp-like stalk. The walls of the canals bear the strong longitudinal muscle-bands, and there are very few spicules.

Polyp-bearing Lobes or Branches.—Looking down into the mouth of the cup, one sees the heads of between sixty and seventy polyp-bearing lobes or branches, but the number visible will of course depend on the degree to which the dome is contracted. Besides the branches on its summit, the central dome bears four whorls, and there are also four tiers on the wall of the cup. It should be noted, however, that the lobes do not all arise singly from the central dome, but may cohere for a distance of 2–6 mm. at their bases. Some are united in pairs; in one case seven were found to be cohering.

Polyps.—Each of the finger-like branches resembles a spike-inflorescence, and bears 150–200 close-set sessile polyps. These almost cover the surface, but without discernible arrangement. At

the summit there is a terminal polyp which is larger than the others. In many cases a branch has a length of 15 mm. and a maximum diameter of 3 mm., but in regard to these and other measurements of soft parts it must be remembered that the whole colony has been much contracted by preservation in strong spirit (plate XVI. fig. 2.).

The polyps have almost globular calyces or verrucae, with a diameter of about 1 mm. The tentacles are in most cases completely retracted, and the summit of the calyx shows a sharply defined circular aperture. The polyps with their calyces and precise circular aperture recall those of some of the Pennatulids, such as Virgulariids. On the wall of the calyx there are eight triangular points, each consisting of two to three pairs of spicules arranged *en chevron*, surmounting a collaret of several horizontal rows. In most cases, however, the projecting spindles of the cortical cœnenchyma hide the base of the calyx and may even intrude upon it. The anthocodia is very minute and is completely retractile within the globular calyx. The tentacles are short and thick, apparently without spicules, and with about half a dozen pairs of pinnules.

Spicules.—Apart from a few irregular minute forms found on the canal walls (and possibly extraneous) all the spicules are spindles. Many are huge, most are densely warted. The warts are often in close-set transverse rows, so that the spindle has a striated appearance. Many of the spindles are curved in a sinuous fashion; not a few are irregularly forked (plate XVI. fig. 3).

The following measurements were taken of the spicules, length and breadth in millimetres:—

From the stalk:	9.5 × .534;	7 × .51;	5.75 × .476.
From the cortex:	5.5 × .476;	3.5 × .28;	1.75 × .153.
From the inner wall of the cup:	5 × .4;	3 × .2;	2 × .15.
From the canal walls:	6 × .51;	4.25 × .4;	2.75 × .32.
From the polyps:	1.6 × .112;	1.02 × .05;	.45 × .034;
		.17 × .018;	.13 × .017.

Position of Staderia.—If this type is to be referred to any of the recognised families of the Alcyonacea it must be to the Alcyoniidae. In the retractility of the whole polyparium, as well as in the mode of branching, the disposition of the polyps and their armature, it is removed from the Nephthyids and Siphonogorgiids.

In certain respects, e.g. the distinct calyces into which the delicate upper parts of the polyps are retracted and the large longitudinal canals continued in part to the base of the colony,

Studeria resembles *Nidalia*, but the *Nidalia* colony is unbranched, and there are many other differences apart from *Studeria*'s retractile polyparium. In certain respects, e.g. in its huge spindles and in the finger-like lobes densely covered with polyps, *Studeria* resembles a form like *Sclerophyllum polydactylum*, but the polyps are quite different in the two, and there is not in *Studeria* any hint of dimorphism. The non-retractile calyces, the mode of branching, the nature of the spiculation, and other features separate *Studeria* from *Aleyonium* and several nearly related genera. So we might review all the genera of Alcyoniidae, but to little profit, for there is only one which can be thought of as having close affinities with our new type. That one is the genus *Paraleyonium*, established by Milne-Edwards. Milne-Edwards gave the following diagnosis of *Paraleyonium*: "Polyparium of a coriaceous tissue towards the base and there forming a cylindrical tube with spiculate walls, into the interior of which all the upper and soft part of the polyparium, including the polyps themselves, can be completely retracted."*

In his original description of *Paraleyonium*, when he called it Alcyonide,† Milne-Edwards gave a number of interesting details. He distinguished a brown firm "foot" fixed by its base, and a white, delicate, branched trunk with twigs ending in small polyps. The cavities of the polyps unite in forming longitudinal canals which are continued to the base, those which lie to the outside having their walls strengthened by numerous brown spindles. Ova are developed on lamellæ in the lower part of the canals of the trunk and fall into the cavity, accumulating further down. On the polyps there are, according to Milne-Edwards, rows of "spicules cartilagineuses brunâtres."

Wright and Studer gave the following definition of *Paraleyonium* in the 'Challenger' Report on Alcyonarians (1889):—"The colony presents two distinct portions: one, the basal portion, is dense, with firm walls; the other, the head, alone bears the polyps, and can be in part withdrawn into the basal part. The polyp-bearing portion is but feebly lobed." In his "Versuch eines Systemes der Alcyonaria"‡ Studer had suggested affinity with *Nidalia*.

Our new type *Studeria* agrees with *Paraleyonium* (1) in having the polyp-bearing portion retractile into the basal portion, (2) in the disposition of the longitudinal canals, and (3) in having very large fusiform spicules. But there the resemblance stops, and there can be no question as to the distinctiveness of the two very remarkable genera.

* Histoire Naturelle des Coralliaires, 1857, p. 129.

† Ann. Sci. Nat., ser. 2, iv. (1835) pp. 323-33 (9 figs.).

‡ Arch. Natur., liii. (1887).

The most obvious differences between *Studeria* and *Paralecyonium* may be summed up in the following contrast:—

Studeria mirabilis.

The polyps are crowded on numerous finger-like branches, which cover a central dome, and also grow out from the inner walls of the cup.

The polyps have a dense armature of spicules, forming a well-defined calyx.

The walls of the cup are very massive and hard.

The retractile polyparium is very substantial, including strong muscle-bands.

The larger spindles are very characteristic, being covered with warts in thick-set rows.

Paralecyonium.

The polyps are distant from one another, and are borne on the ends of the twigs of a loosely-branched polyparium.

The polyps have minute spicules at the base of the tentacles, but there is no calyx.

The walls of the cylindrical lower portion are not thick, and the whole is readily compressible.

The retractile polyparium is very delicate and translucent.

The spindles are much smaller, and much less warty.

It should be noted that *Studeria mirabilis* is much larger than *Paralecyonium elegans*, much more massive, with much larger and coarser spicules, and so on; but we have reason to believe that the massiveness of architecture is a specific, not a generic character. We saw in September in the Zoological Museum in Hamburg a number of un-named specimens of a form which we believe to be closely related to *Studeria*. By the courtesy of the director, Professor Kraepelin, and of Dr. Michaelsen, who has charge of the section of the museum containing Aleyonaria and the like, we were able to examine this form, and to compare it with the 'Investigator' type. The Hamburg specimens, which were collected off Formosa (Takao), agree with the 'Investigator' specimen in having a retractile polyparium, similar polyps, and the same type of huge warty spindle, but they have not the strong massive cup, nor, so far as we have seen, the same development of central dome, or of digitiform lobes. We do not wish to pursue the comparison in the meantime, since Professor Kükenthal has, we believe, undertaken to describe the un-named Aleyonarians in the Hamburg Museum. We would, however, express our conclusion that the Hamburg specimens belong, or are closely related, to the genus *Studeria*, which we have established for the 'Investigator' type. [It must be added that we exhibited, described, and named the 'Investigator' specimen in August 1907, at the Meeting of the International Congress of Zoologists at Boston. As we have heard nothing regarding the manuscript which we deposited, we have thought it necessary to record the facts afresh.]

M. Camille Viguier* has described and given beautiful figures of a type which he calls *Fascicularia*, and has proposed to include *Paralecyonium* along with it in a special family or sub-family, Fasciculariinae. But it is not evident that *Fascicularia* is really related to *Paralecyonium*: it consists of groups united by stolons; the cavities of the polyps are continued, quite distinct from one another, down the "basilar column;" there is no common region except the base; the large polyps expand from the top of the basilar column, but there is no branched or lobed polyparium; in fact, as the author says, there is no polyparium properly so-called. He makes the same remark, it is true, in regard to *Paralecyonium*, which, however, he had not seen. What at once marks *Paralecyonium* as distant from *Fascicularia*, is the presence of a branched polyparium rising from the top of a firmer cylindrical stalk, into which it can be retracted. Viguier speaks of the "incontestable resemblance" between his *Fascicularia* and the *Paralecyonium* of Milne-Edwards, but we are unable to share this view. The description of *Fascicularia* suggests to us relationship with *Sympodium* rather than with *Paralecyonium*.

A recent careful study† of abundant material of *Fascicularia* and *Paralecyonium* by Sophie Motz-Kossowska and Louis Fage corroborates Viguier's view. In their interesting paper the authors point out that the two types agree (1) in having a stolon connecting the colonies (but this is often almost suppressed in *Paralecyonium*); (2) in having a rigid basal portion into which the polyps can be retracted (but in *Fascicularia* this is composed of the unfused gastric cavities of the polyps, whereas in *Paralecyonium* there has been much coalescence, and therefore far fewer longitudinal canals than polyps; moreover, *Paralecyonium* has a branching polyparium with secondary polyps arising from primary polyps); (3) in having similar spicules—small, flat, opaque elliptical forms in a sub-tentacular collar and larger spindles in the basal portion (but the spindles are very much larger in *Paralecyonium*). The authors point out that *Paralecyonium* passes through a *Fascicularia* stage, and in spite of the great difference in the basilar portion and in the relations of the polyps to one another, they unite them in the family Fascicularidæ, defined as follows: "Colonies very poor in cœnenchyma, composed of several groups of polyps united by a stolon; polyps united at the base in a rigid column within which they can be completely retracted." It is suggested that the family is connected by *Fascicularia* with the Clavularidæ, that there are some affinities with *Nidalia* and

* Études sur les animaux inférieurs de la Baie d'Alger. III. Un nouveau type d'Anthozoaire (*Fascicularia edwardsi*). Arch. Zool. Expér. ser. 2, vi. (1888) pp. 351-73 (2 pls.). See also H. de Lacaze-Duthiers; Coralliaires du Golfe du Lion. Alcyonaires. Arch. Zool. Expér. ser. 3, viii. (1900) pp. 353-462 (4 pls.).

† Contribution à l'étude de la famille des Fascicularidés. Arch. Zool. Expér., vii. (1907) pp. 423-43 (10 figs.).

Nidaliopsis, and that the nearest related form is *Organidus*. The armature of the polyps in *Nidalia*, its unbranched habit, and many other features separate it far from *Paralegonium*, and *Gersemia*, to which, as Kükenthal has shown, *Organidus* must be referred, is equally remote.

We have not as yet been able to procure a specimen of *Fascicularia* for examination, and we would not therefore dogmatically exclude the possibility that *Fascicularia*, *Paralegonium*, and *Studeria* form a series showing the progressive differentiation of a rigid basilar portion into which the rest of the colony can be retracted. The descriptions given by Motz-Kossowska and Fage are very precise, and their discussion of the possible relationships is admirable; what surprises us is that in spite of the differences which they indicate between *Fascicularia* and *Paralegonium*, they should propose to include the two in one family. From their descriptions, as from Viguier's, it appears to us that *Fascicularia* is more nearly related to *Sympodium* than to *Paralegonium*; that it differs from *Paralegonium* too markedly (in the structure of the basilar portion and in the relations of the polyps to this and to one another) to allow of their being included in one family; and that neither is nearly related to *Studeria*.

Diagnosis of Studeria.—A colony consisting of a strong densely spiculate cup, within which very numerous finger-like polyp-bearing lobes or branches are retracted; these arise at different levels from a strong muscular central thalamus, and from the upper parts of the inner wall of the cup; each finger-like lobe is thickly covered with polyps and ends in a polyp larger than the rest; the cavities of the polyps communicate with a central canal in the digitiform lobe, and these central canals unite in a few large longitudinal canals with few spicules in their walls; the polyps have a distinct non-retractile calyx or verruca, covered with spindles arranged in double rows; the spicules are all spindles, except a few minute irregular forms found (along with sparse spindles) in the canal walls; many of the cortical spindles attain huge dimensions (over 9 mm.); many are sinuous and forked; almost all are very warty, and there is a characteristic arrangement of the warts in transverse rows.

Our general conclusion, which is based on a single specimen, of which we had to be careful, is that we have to do with a very distinct genus, related to *Paralegonium*, but not very closely; perhaps connected through forms like *Nidalia* with other Aleyniidae; but more probably deserving, as Professor Verrill suggested to us, the establishment of a new family.

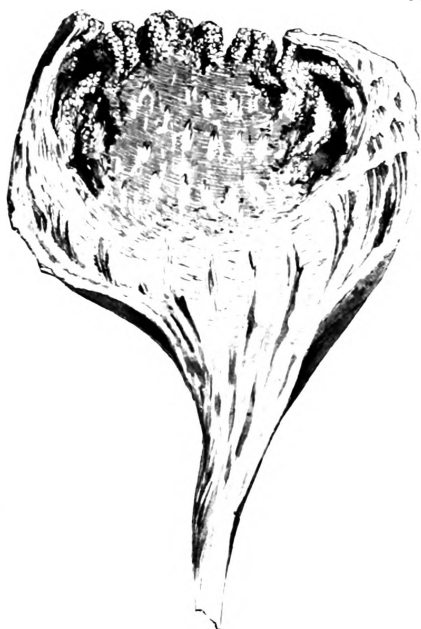


FIG. 1. Longitudinal section of *Staderia mirabilis* g. et sp. n. Natural size.



FIG. 2. The upper part of one of the digitiform polyp-bearing lobes or branches of *Staderia mirabilis* g. et sp. n. It shows the terminal polyp much larger than the others. $\times 12$.

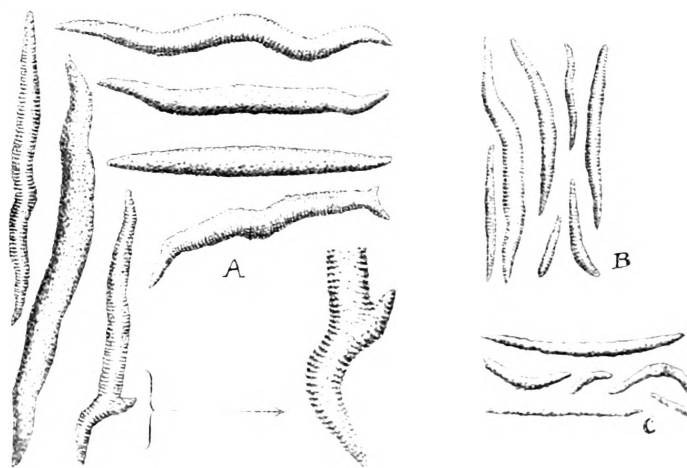


FIG. 3. Spicules of *Staderia mirabilis*.

A. From the stalk. B. From the internal wall of the cup. C. From a polyp-bearing lobe.

